GE Consumer & Industrial
Multilin

MultiLink ML1600/ML2400 Ethernet Communications Switch

Quickstart Guide

Firmware Revision 2.1x

Manual P/N: 1601-9026-A2
Manual Order Code: GEK-113393A

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GE Multilin's Quality Management System is registered to ISO9001:2000

QMI # 005094
UL # A3775

These instructions do not purport to cover all details or variations in equipment nor provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the General Electric Company.

To the extent required the products described herein meet applicable ANSI, IEEE, and NEMA standards; but no such assurance is given with respect to local codes and ordinances because they vary greatly.

GE Multilin Multilink ML1600/2400 Quickstart Guide for revision 2.1.x.

Part numbers contained in this manual are subject to change without notice, and should therefore be verified by GE Multilin before ordering.

Part number: 1601-9026-A2 (March 2008)

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QS.1 Introduction to Twisted Pair and Fiber Optic Ethernet LANs

This section will provide a brief review of modern Ethernet media before covering the steps to correctly configure the Multilink switch for typical protective relaying applications. For this discussion the range of IP addresses that will be used are within the range of 3.94.247.1 to 3.94.247.254 using a subnet mask of 255.255.255.0. This same range of addresses can be used for testing purposes but you should contact your IT support group for a valid range of addresses to be used for your particular application.

QS.1.1 Ethernet Physical Layer: Twisted Pair Copper vs Fiber Optic

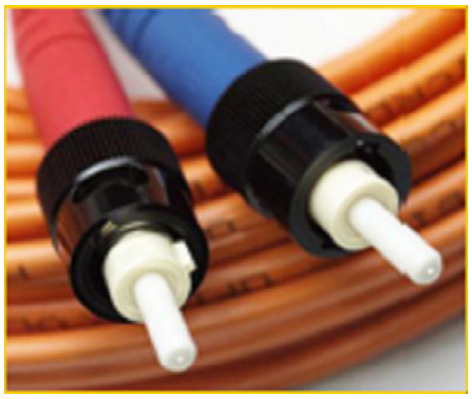
Today, the two most popular physical layer standards for Ethernet are twisted pair copper cable and fiber optic cable. Twisted pair copper is easier to terminate, has lower installation costs but is susceptible to electrical noise and a single run of twisted pair cable is distance limited.

Fiber optic media typically is able to be applied over much longer distances, is immune to electrical noise and while being more difficult to terminate the availability of per-fabricated cables has reduced the complexity of the installation within the substation dramatically.

Twisted Pair copper cable

- Easy to Terminate
- Low installation costs
- Susceptible to noise interference
- Limited by 100m distance
- Either shielded or unshielded (UTP)

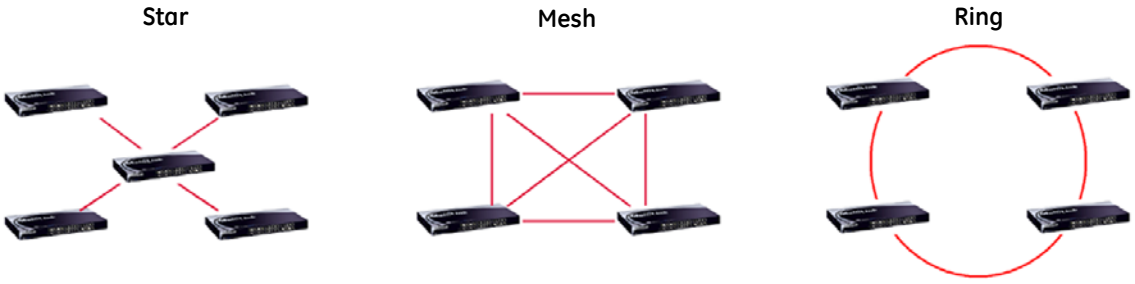
Fiber



- Longer distances possible, limited only by attenuation
- Immune to electrical noise
- More difficult termination and splicing
- Slightly higher cost for cable
- Two categories:
    - multi-mode
    - single-mode

QS.1.2 Supported Network Topologies

With either media supported topologies include: star, mesh and ring. The port that connects one switch to another is often called the uplink port and with many switches the uplink port can operate at much higher baud rates than the standard ports. The link formed by the connection of of several switches higher speed uplink ports is often referred to as a backbone.



Star Architecture

- Single Point of failure before loss of communications
- Additional Ethernet switches Required
- Network Recovery in approximately 6 ms per Ethernet switch

Mesh Architecture

- Multiple Points of failure required before loss of communications
- Additional Fiber Cables required

Ring Architecture

- Full Network Redundancy
- Allows for Fastest Network Recovery *
- Most Cost Effective Solution

* RO mode has typical recovery time of ≤ 5 ms/hop.

QS.2 10BASE T and 100BaseT Media

10 Base T and 100 Base T are the two most common twisted pair copper media standards. There are also several popular fiber optic media standards which we will review later in this section. With respect to 10 or 100 Base T, the 10 or 100 designation indicates a baud rate of either 10 or 100 megabits per second. Base stands for baseband while the T stands for "twisted pair."

Since many twisted pair interfaces can work at either baud rate, the designation 10/100 Base T has evolved to show this capability. The cable can be ether unshielded twisted pair (UTP) or shielded twisted pair (STP).

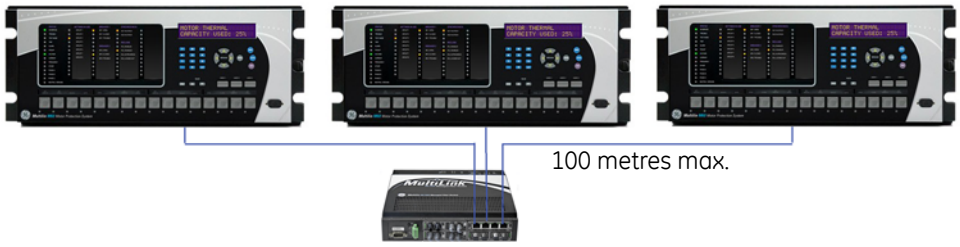
We recommend category 5e UTP for applications of up to 100 Mbs

Unshielded Twisted Pair cable:

- Category 1: Used for telephone communications; not suitable for transmitting data.
- Category 2: Capable of transmitting data at speeds of up to 4 Mbps.
- Category 3: Can be used in 10BASE-T networks; can transmit data at speeds up to 10 Mbps.
- Category 4: Used in Token Ring networks; can transmit data at speeds up to 16 Mbps.
- Category 5: Capable of transmitting data at speeds up to 100 Mbps.
- Category 5e*: Used in networks running at speeds up to 1000 Mbps (1 Gbps).
- Category 6: Consists of four pairs of 24-gauge copper wires, which can transmit data at speeds of up to 1000 Mbps.

* Recommended

Ethernet: Unshielded Twisted Pair



:

RJ45 Pin # (END 1)	Wire Color	Diagram End #1	RJ45 Pin # (END 2)	Wire Color	Diagram End #2
1	White/Orange		1	White/Orange	
2	Orange		2	Orange	
3	White/Green		3	White/Green	
4	Blue		4	Blue	
5	White/Blue		5	White/Blue	
6	Green		6	Green	
7	White/Brown		7	White/Brown	
8	Brown		8	Brown	

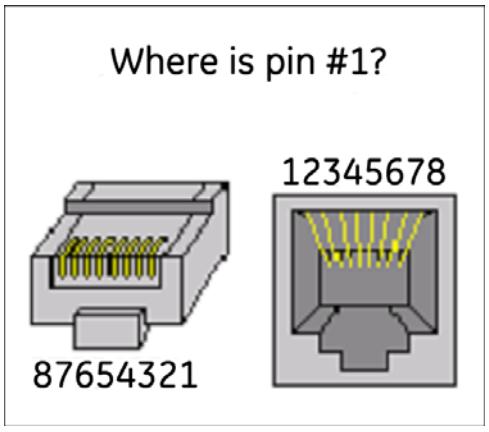


FIGURE QS–1: Pin Layout for a RJ45 Ethernet Straight-through Cable

The cable itself consists of four pairs of wires terminated in RJ45 connectors. The maximum permitted cable length is 100 meters. The cable pin connections can be one of two configurations. The first is called a "straight-through" cable and the second is called either a "crossover" or a "patch" cable. Whether the cable is straight-through or crossover as per standard* each of the wires within the cable has the following color code:

For the first twisted wire pair or wire pair #1: one wire is White with Blue bands while the other wire is Blue.

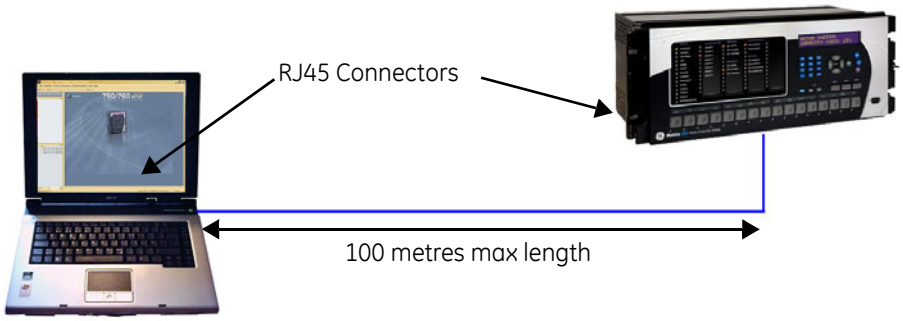
For the second twisted wire pair one wire is White with orange bands while the other wire is orange.

The third twisted wire pair #3 consists of a white wire with green bands and a second wire that is green.

The final wire pair, wire pair #4 consists of a white wire with brown bands while the other wire is Brown.

* The Electronic Industry Association (EIA) / Telecommunications Industry Association's (TIA) Standard 568B

The pin and wire configuration of a patch or crossover cable used to connect or establish a point-to-point Ethernet LAN between two Ethernet devices is shown here.



RJ45 Pin # (END 1)	Wire Color	Diagram End #1
1	White/Orange	
2	Orange	
3	White/Green	
4	Blue	
5	White/Blue	
6	Green	
7	White/Brown	
8	Brown	

RJ45 Pin # (END 2)	Wire Color	Diagram End #2
1	White/Green	
2	Green	
3	White/Orange	
4	Blue	
5	White/Blue	
6	Orange	
7	White/Brown	
8	Brown	

FIGURE QS–2: Pin Layout for RJ45 Ethernet Crossover (Patch) Cable

QS.3 Hubs and Switches

Two of the major Ethernet LAN components are "hubs" and "switches." There are many advantages of a switch over a hub. Hubs just transfer information from one port to all other ports. Since a hub has no way of handling media contention, collisions can occur requiring all segments connected to a hub to work in a half duplex mode. Switches on the other hand have the capability of buffering messages allowing full duplex operation. A switch will also learn the MAC addresses of devices connected to each of it's ports and will then route messages to just the port to which the destination device is connected, thereby reducing data traffic on the network. Switches that have configuration firmware to customize the switch and traffic are called "managed switches". Switches that have fixed configurations are referred to as "unmanaged switches".

QS.3.1 Fiber Optic Ethernet:

Fiber optic Ethernet is rapidly becoming the medium of choice in applications where longer distances and immunity to EMI are of importance, such as power system applications. However, the higher cost and the difficulty of terminating fiber cables allows twisted pair to continue to play a roll were appropriate.

The wavelengths of light used in fiber optic communication are 820, 1300 and 1550 nanometers (nm) because it has been found that these wavelengths of light are attenuated the least as they travel through the fiber optic medium. Compatible ports must operate at the same wavelength of light and be linked with appropriate fiber. There are two categories of fiber optic cable: "multi-mode" and "single-mode." Note that until recently, the cable used with 820nm wavelength light was offered only in multi-mode while 1300nm wavelength light uses both single and multi-mode compatible cable. Cable compatible with 1550nm wavelength light is offered only in single mode.

Wavelengths of light

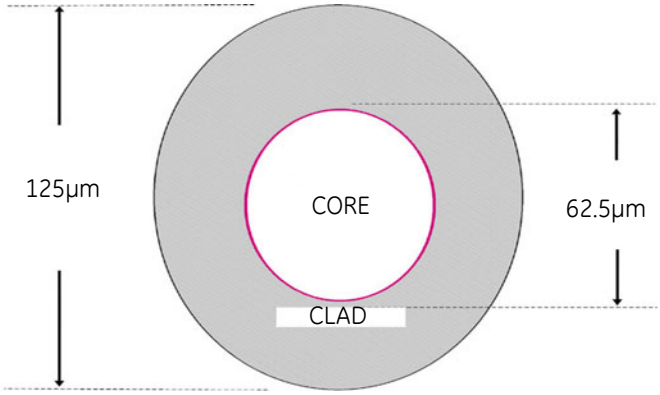
	Multi-Mode	Single-Mode
820nm	X	X
1300nm	X	X
1550nm	N/A	X

Note that both devices must use the same wavelength of light.

QS.3.2 Single and Multi-mode cable

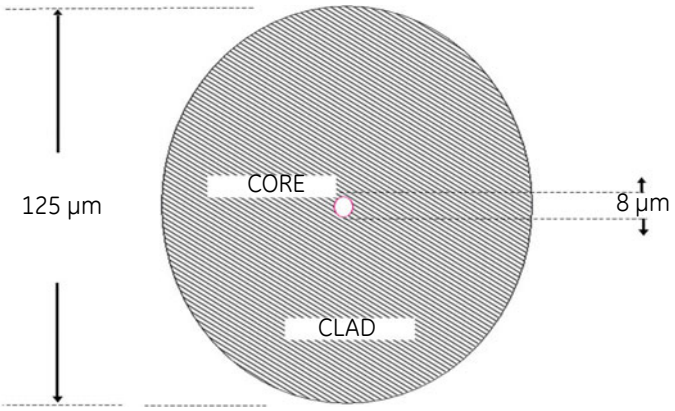
Fiber Cable Cross Section and Physical Specifications

Multi Mode



- 62.5/125 µm
- 50/125 µm*

Single Mode



- 9/125 µm

* Will become more popular as baud rate goes up

This is a scaled drawing of both a 62.5/ 125 µm multi mode fiber and 9/125 µm single mode fiber. The outer clad of both is 125 micrometers in diameter. The multi-mode core, at 62.5 micrometers, is a little bit thinner than the average human hair. The core of the 9/125

micrometer fiber is 8 microns in diameter (almost an eighth of that of the Multi-Mode fiber) surrounded by a second outer clad. This clad can pass a light signal, so for this reason the fiber is referred to as 9 by 125 micrometer fiber.

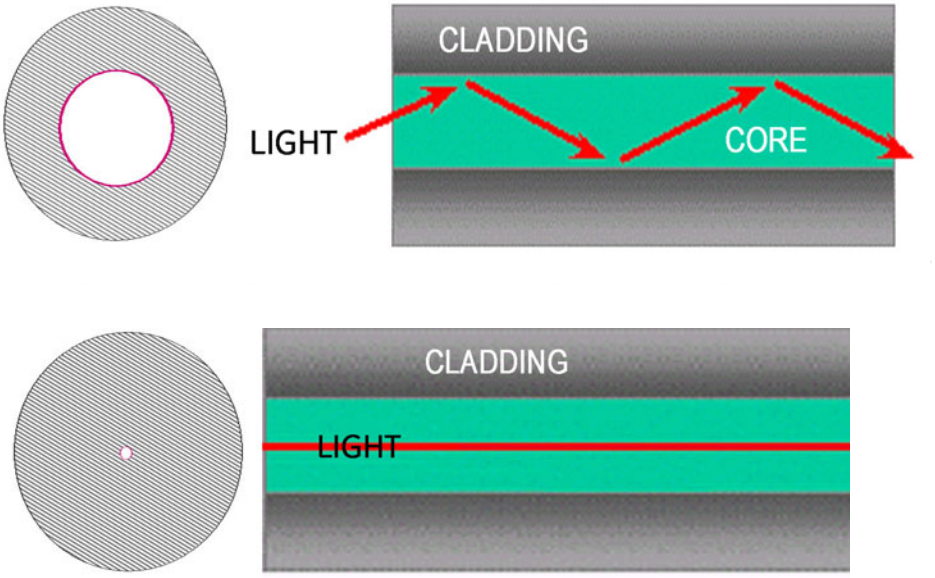


FIGURE QS–3: Differences between Multi-Mode and Single-Mode Cable

Single mode fiber - Less attenuation per unit distance

The difference between multi-mode and single mode cable can be best described as follows:

With multi-mode fiber the index of refraction at the surface between the core and the cladding is such that there is total internal reflection of the light being transmitted down the core. Picture this by imagining that the clad is a tube whose interior surface is polished so smooth, it is like a mirror. Light shinning at one end of the tube will either travel straight down the tube or will travel down the tube by reflecting of the inner mirrored surface.

Single mode fiber can be described as an elongated lens that is continuously focusing the light into the centre of the fiber. Using these two analogies it can be imagined that in the single mode fiber more light travels through far less fiber medium resulting in far less attenuation per unit distance than it does in multi-mode fiber. As a result, for a given wavelength of light, single mode fiber typically has less attenuation per unit distance than multi-mode fiber.

QS.4 Optical Power Budget

Inevitably the question that arises is “What is the maximum practical communication distance when using a fiber optic cable?”. The answer isn’t straightforward, but must be calculated as follows:

- First the "Optical Power Budget" is determined by subtracting the receiver’s rated sensitivity from the transmitter’s rated power, both of which are defined in decibels of light intensity. For example if a particular transmitter is rated at minus15 db and the receiver’s sensitivity is rated at minus 31 db, the difference of 16 db is the "Optical Power Budget."

```
Xmt Output Pwr - Rcv Sens = OPB: Optical power budget
Magnum: ( -15.0 dB ) - (- 31.0dB)= -16 dB OPB
```

  The Optical Power Budget can be thought of as the maximum permitted attenuation of the light signal as it travels from the transmitter to the receiver, while still permitting reliable communication.

- The next step is to calculate the worst case Optical Power Budget by subtracting from the Optical Power Budget, 1 dB for LED aging and 1 dB for each pair of connectors (referred to as "insertion loss").

```
Worst Case OPB = OPB - 1dB (for LED aging) – 1dB (insertion loss for
each pair of connectors) x number of pairs
```

  The final step is to divide the calculated result by the rated cable loss per kilometer to determine the maximum distance.

For costly installations it is recommended that you always measure the actual cable loss before and immediately after the installation to verify that the cable was installed correctly. To avoid damaging the receiver, ensure that the maximum optical input power of the receiver isn’t exceeded.

- Worst case distance = {Worst case OPB, in dB} / [Cable Loss, in dB/Km]

where the “typical cable loss” for:

- 62.5/125 and 50/125ìm (M.m) is 2.8 dB/km
- 100/140 (Multi-mode, 850nm) is 3.3 dB/km,
- 9/125 (Single-mode, 1310nm) is 0.5 dB/km (a worst case industry number)
- 9/125 (Single-mode, 1310nm) is 0.4 dB/km (LXSC25)
- 9/125 (Single-mode 1550nm) is 0.25 dB/km (ZXSC40, SSCX)
- 9/125 (Single-mode 1550nm) is 0.2 dB/km (ZXSC70) and
- 9/125 (Single-mode 1550nm) is 0.22 dB/km (ZXSC120)

These are typical cable losses. There will be deviations depending on the manufacturer. Always measure the loss before installation.

Several styles of connector are used to terminate the attached to the end of the fiber cable. The ST and SC connectors shown below, are among the more popular. Ensures that the UR CPU, switch, and cable have compatible connectors.

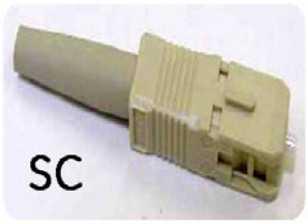
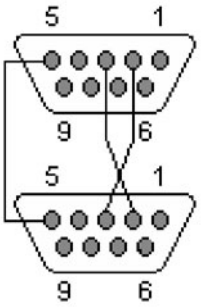


FIGURE QS–4: Common Fiber Optic Connectors

QS.4.1 Assigning an IP address to the Multilin Switch

DB9 Female to DB9 Female Cable Pin-out	
Pin 2	Pin 2
Pin 3	Pin 3
Pin 5	Pin 5

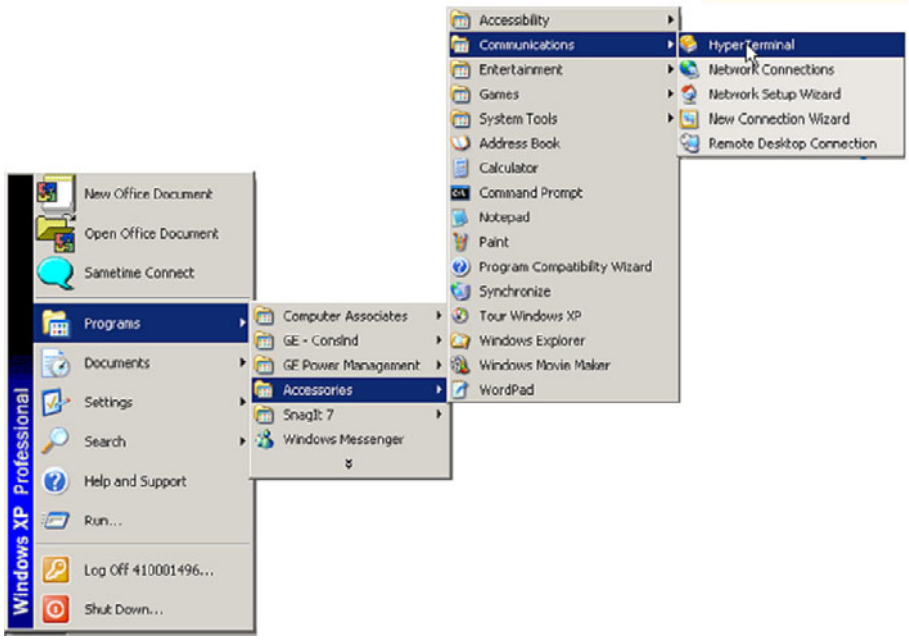


The easiest way to configure the switch is through the WEB interface. The switch has been shipped with a default IP address of 192.168.1.2 and a subnet mask of 255.255.255.0. Consult your network administrator to determine if the IP address, subnet mask or default gateway needs to be modified. In our example test network the valid rang of IP addresses is from 3.94.247.1 to 3.94.247.254.

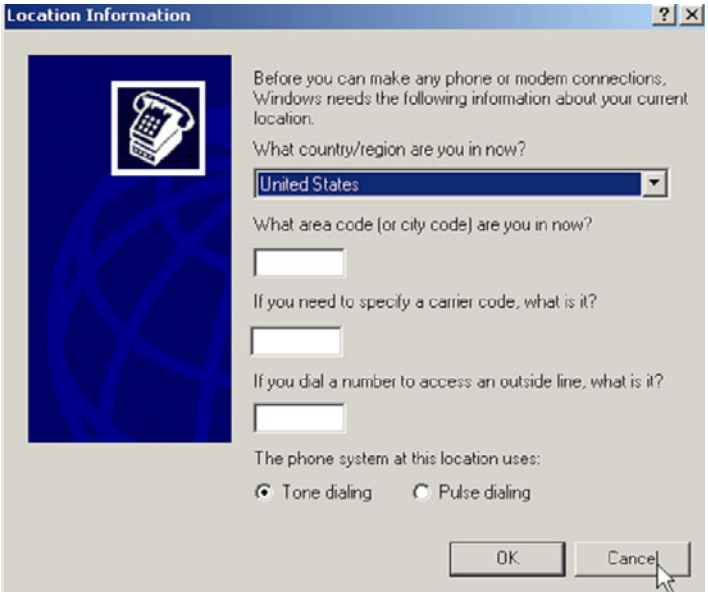
The easiest way to assign an IP address and subnet mask is through the switches console serial port. A diagram of the required cable's pin-out is shown above. Note that both ends of the cable are terminated in a DB9 pin female connector. Pins 5 of this cable are

connected together while pin 2 at one end is connected to pin 3 at the other end. Once you have obtained a cable with this pin configuration, connect one end to the computer's serial port and the other to the Multilink switch port.

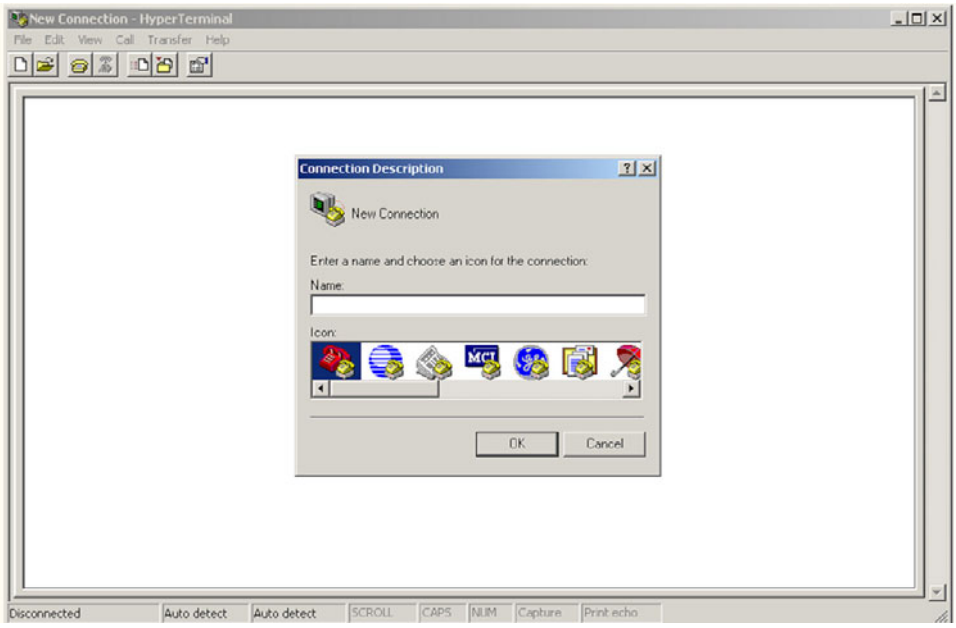
The Hyperterminal utility application is a convenient standard firmware tool that will be used to configure the switch. This program is found on most windows based operating systems under programs > accessories > communications > Hyperterminal.



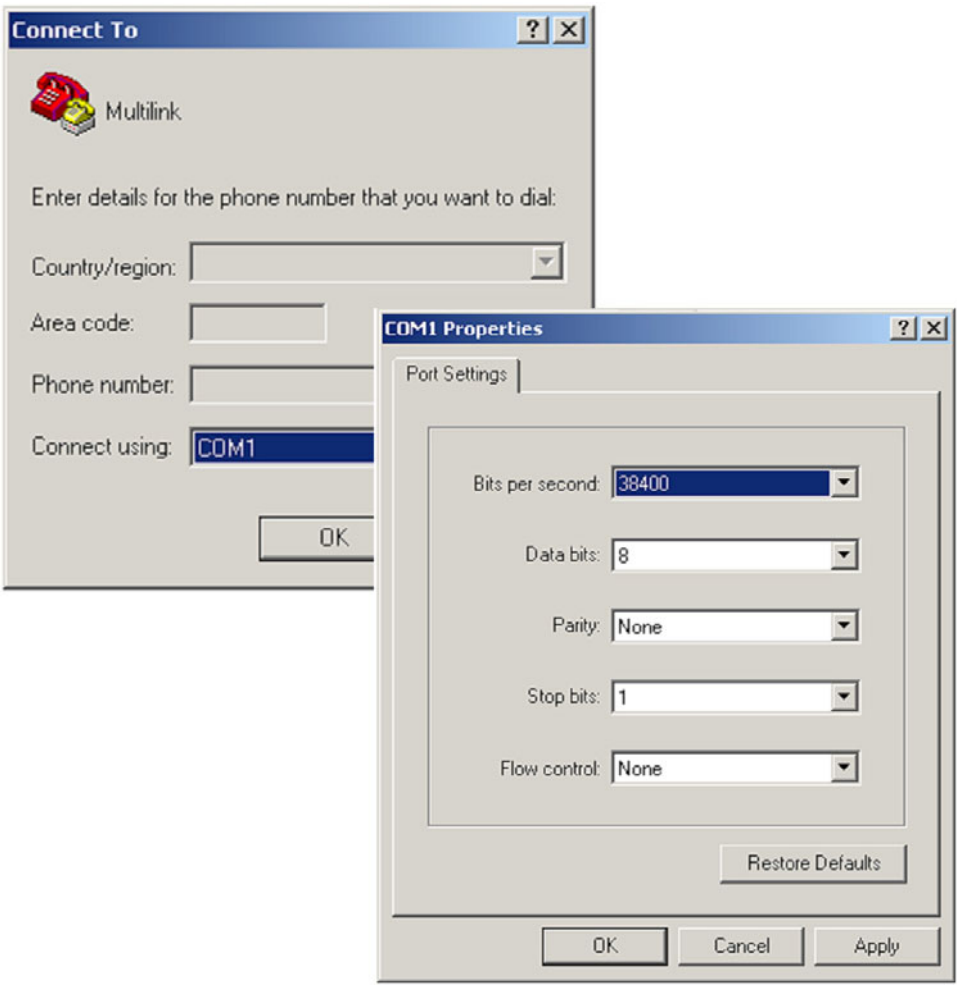
▷ Once the HyperTerminal application is launched you will need to cancel HyperTerminal's dial sequence by left mouse clicking on the **Cancel** pushbutton. This will allow you to access Hyperterminal's configuration menus.



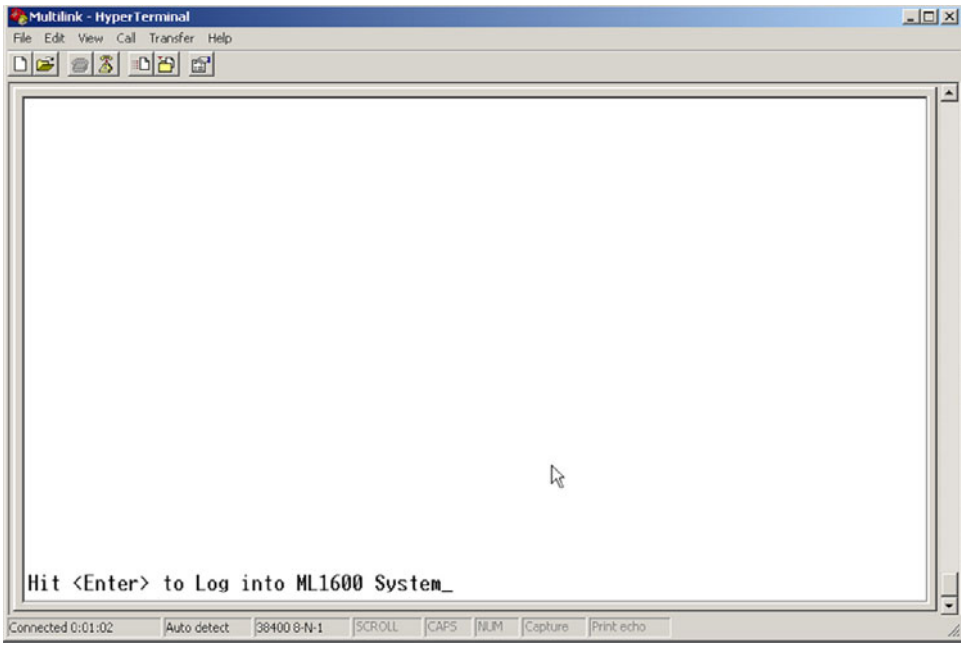
▷ Select an icon and name to use for saving the new Hyperterminal configuration.



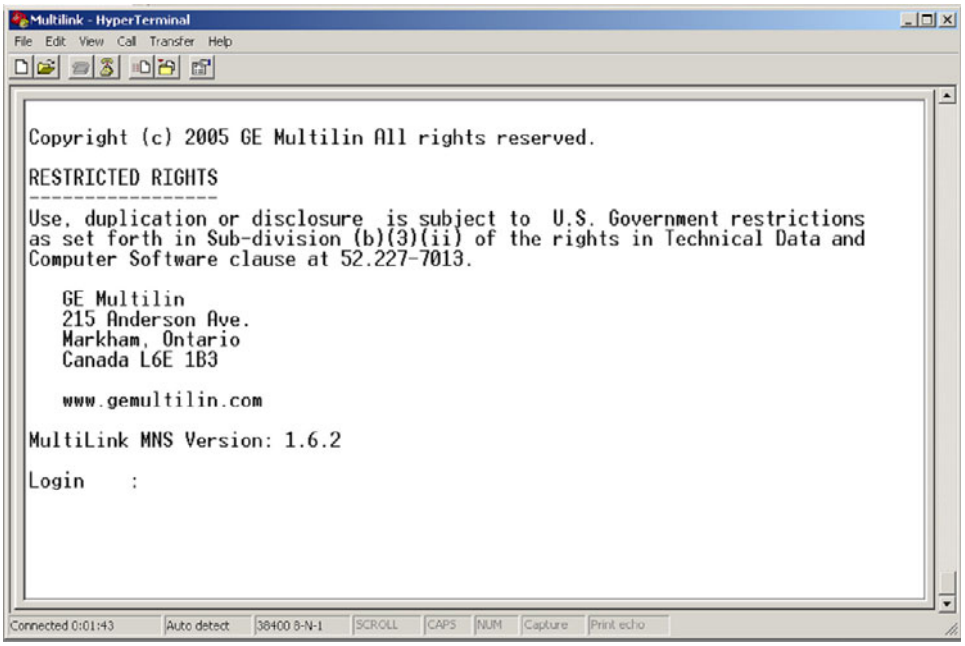
- ▷ Select the computer's serial port that is connected to the Multilink switch.
- ▷ Select **OK**.
- ▷ In the next window set the baud rate to **38400**, data bits to **8**, **no parity**, **one stop bit** and set the flow control to **none**.
- ▷ Left mouse click on the **OK** icon to attempt communication to the Multilink switch.



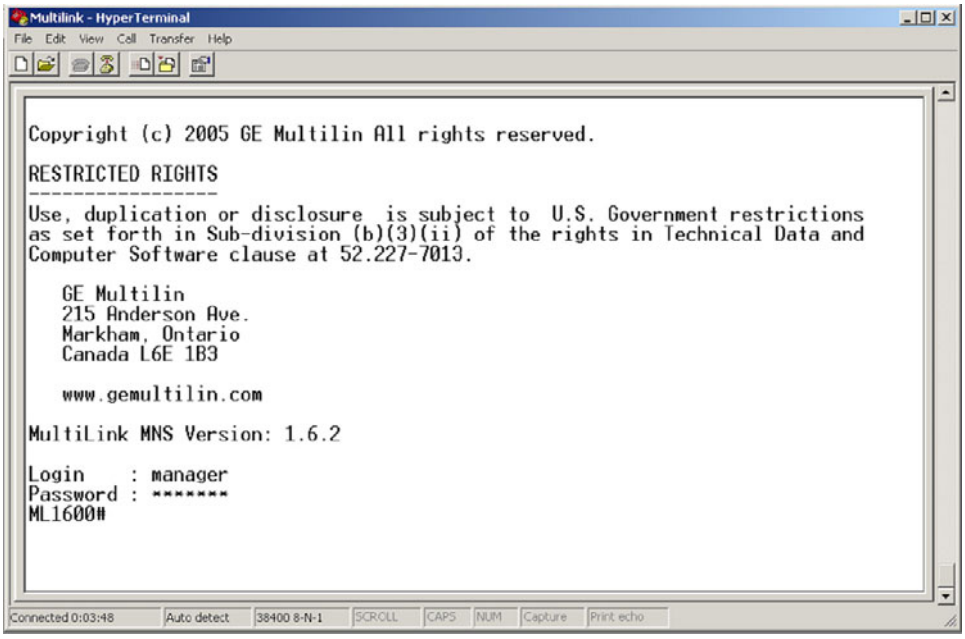
▷ Press the **Enter** key until the message **Hit <Enter> to log into ML1600/2400 system** is displayed.



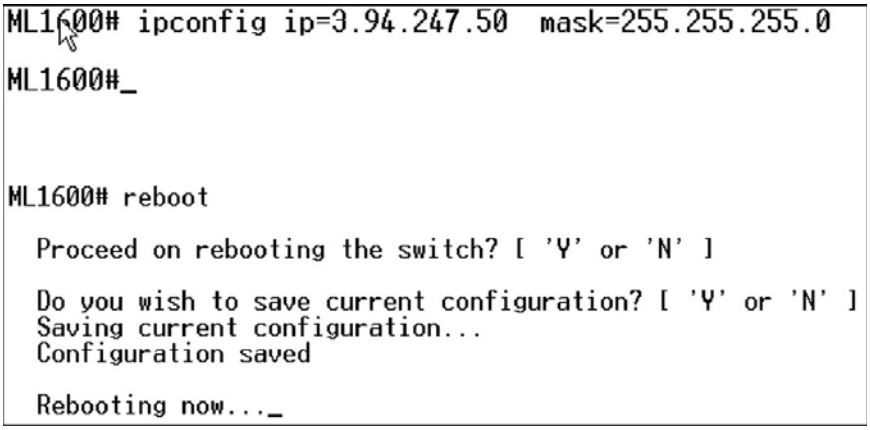
▷ Press the **Enter** key one more time to get the login prompt.



▷ Enter the login name **manager** and the default password **manager**.
Once you are successfully logged in, the prompt will change to the model number of the switch you are connected to, followed by the **pound (#) sign,** indicating a successful login.



In this example the switch that the computer is connected to is a **Multilink ML1600**.



The instruction manual for the MultiLink provides a list of all instructions. A valid IP address and subnet mask can be programmed into the switch using the **IP config** command as follows:

- Type **ipconfig ip=**, then enter the IP address (in our example we will use a unique address between 3.94.244.1 and 3.94.244.254), followed by a space.
- Type **mask=**
- Enter the mask (in our example system we would use 255.255.252.0).
- If a default gateway is also required enter a space and type **dgw=**
- Enter the ip address of the gateway.

- ▷ Select the **Enter** key.
  The switch will ask if you would like to reboot the switch.
- ▷ Select **Y** for yes and **Y** again to save the new settings.
- ▷ Once the switch has completed a reboot, the new IP and subnet mask will be in effect.

```
Login    : manager
Password : *******
ML1600# show setup

  Version             :  ML1600 build 1.6.2 May 12 2005 18:43:35
  MAC Address         :  00:20:06:2b:33:30
  IP Address          :  3.94.248.1
  Subnet Mask         :  255.255.255.0
  Gateway Address     :  3.94.248.1
  CLI Mode            :  Manager
  System Name         :  ML1600
  System Description  :  16 Port Modular Ethernet Switch
  System Contact      :  multilin.tech@ge.com
  System Location     :  Markham, Ontario
  System ObjectId     :  1.3.6.1.4.1.13248.12.6

ML1600#
```

Once the switch has rebooted you will need to log in again. To confirm that the IP address and subnet mask were saved correctly enter the command **show setup** followed by the **Enter** key. The Multilink switch will then provide an on-screen list of the switch settings including the switch IP address and subnet mask and if programmed, the default gateway. Once you have verified that the IP, subnet mask and default gateway settings are correct you can configure the switch via the web interface.

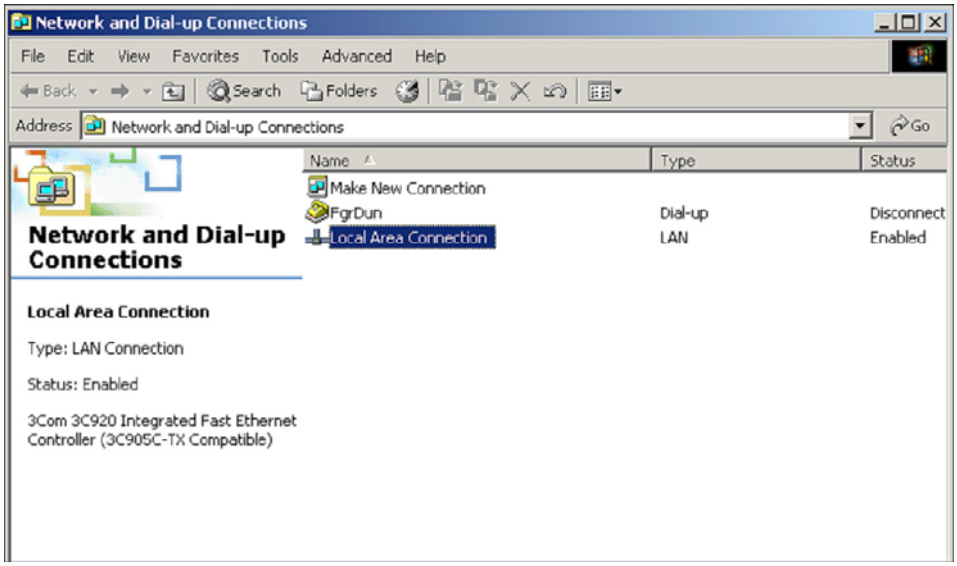
QS.4.2 Assigning a static IP Address to a personnel computer

In order to configure the switch using the web-based interface the computer must be assigned an IP address and subnet mask. If you are already familiar with this procedure you may skip this step.

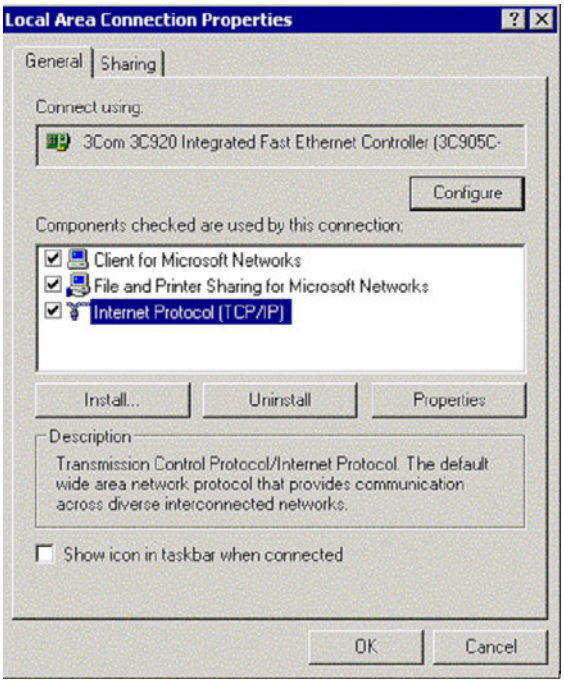
▷ **Obtain an IP address, subnet mask, and possibly a gateway address, from the LAN administrator.**

There are rules associated with the assignment of these numbers, which go well beyond this introduction. As mentioned at the beginning of this guide, for our test network we will be using a subnet mask of 255.255.255.0 for all computers and relays on the network. The IP address of each device on the network must be unique. Given that in this example the switch was assigned an IP address, 3.94.247.50, we are left with 253 unique addresses.

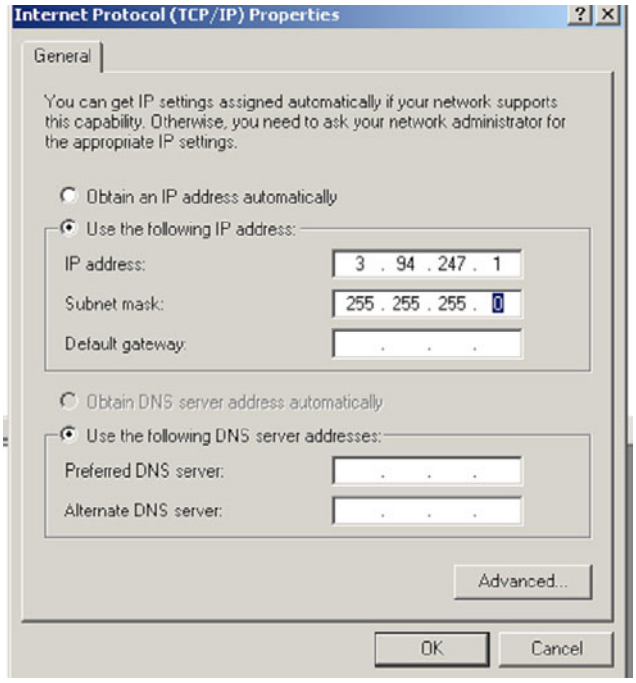
▷ Once the computer has booted up, right click on the icon labeled **My Network Places** followed by the **Properties** selection.



▷ Right mouse click on the **Local Area Connections** icon and select **Properties**.



▷ Locate and click on the Ethernet card (it will have **TCPIP Protocol** as part of its name).
The Ethernet card is typically referred to as an **Ethernet adaptor**.



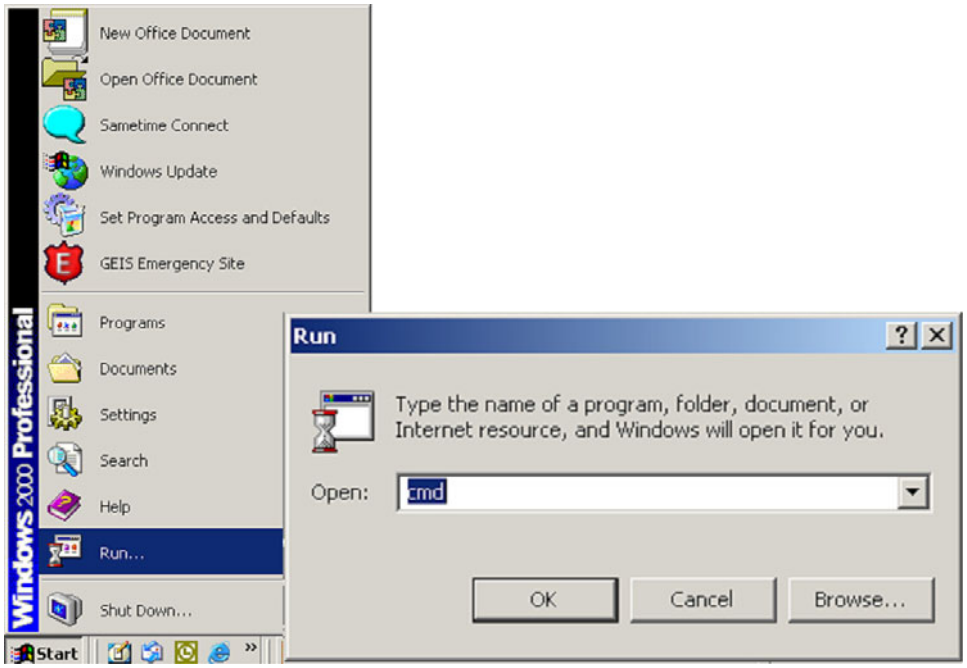
▷ Select **Use the following IP address** then enter a unique IP address (from 3.94.247.001 to 3.94.247.254 if using our test network address range).

▷ Enter the subnet mask which, if using our test network, will be 255.255.252.0.

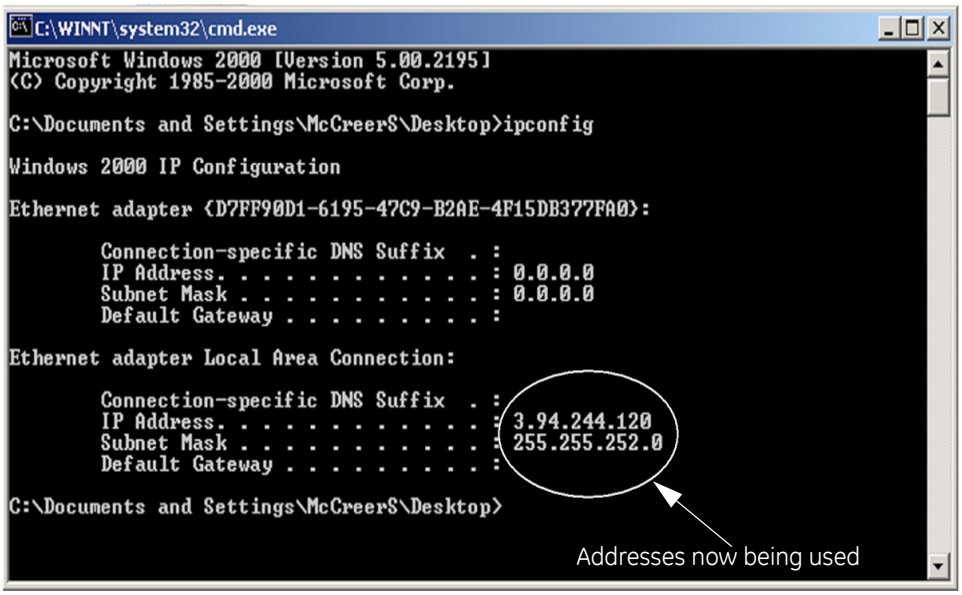
▷ Select **OK**, then **OK** again to exit the LOCAL AREA NETWORK PROPERTIES menu.

▷ Connect the computer's Ethernet port to the switch using a straight-through cable.

▷ Ensure that the link LED come on, on both the switch and PC.



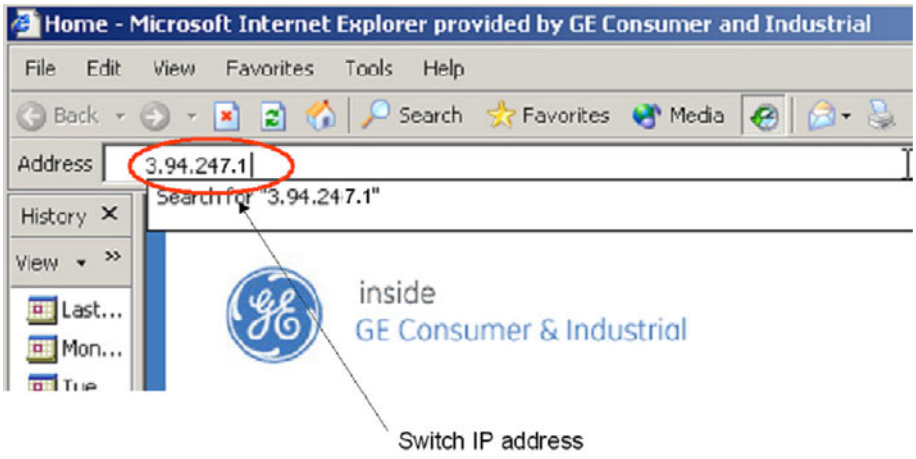
▷ Select **Run** then enter **CMD** to start the DOS shell.



Once the DOS shell has launched, you will be presented with a DOS window.

▷ At the DOS prompt enter the command **ipconfig** followed by the **Enter** key.

This is the command that will cause the Ethernet adaptor to immediately use the IP, and Subnet Mask addresses just programmed. An on-screen report will appear indicating which addresses are now being used by the adapter. The computer's configuration is complete.

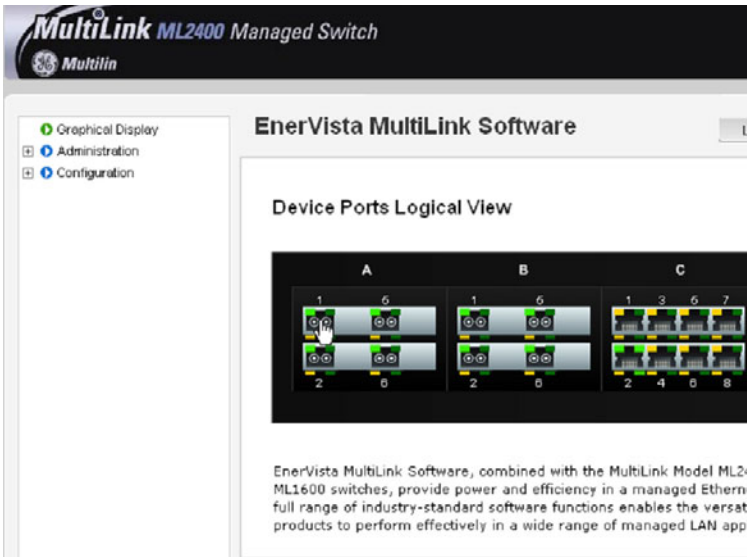


▷ Next launch **Internet Explorer** and enter the IP address of the switch to go to the switch's web page.

▷ At the Multilink login web page, enter the default Login name, which is **manager**.

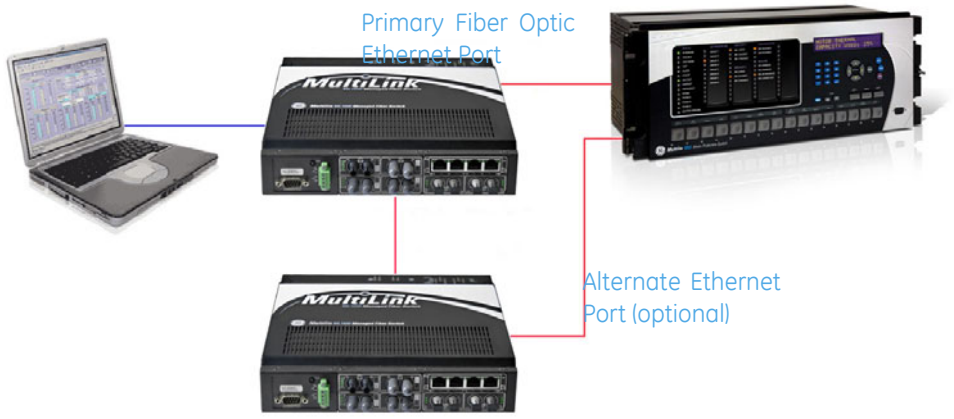
▷ Enter the default login Password, which is again **manager**.

▷ Left mouse click on the **Login** pushbutton to attempt to log in.



If you have successfully logged in you will be presented with a graphic of the particular Multilink switch to which you are connected.

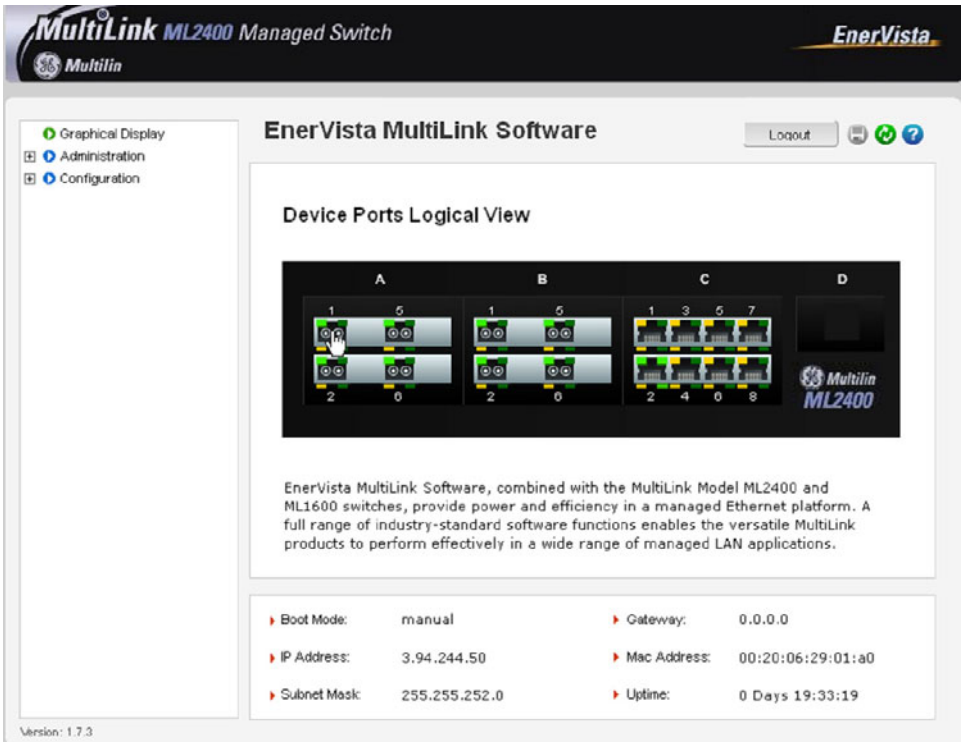
QS.4.3 Configuring the switch ports for UR redundant operation



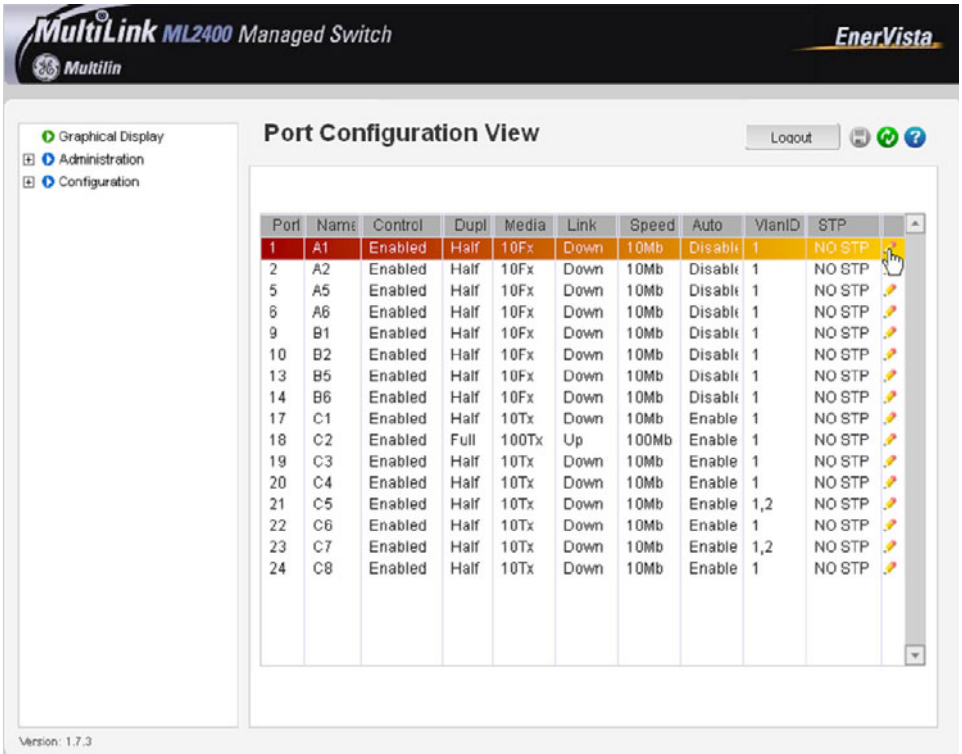
The universal relay offers a redundant port option once the link loss alert feature is enabled on the associated port, the relay will be able to detect a failure of the link, alarm, and switch to the alternate port. The following procedure should be used to enable Link Loss Alert on each of the the ports used in the redundant configuration.

▷ Note the names of all switch ports that will require the Link Loss Alert feature to be enabled.
In our example the port named **A1** is one of the ports that will be used in a redundant configuration, so the Link Loss Alert feature must be enabled on this port.

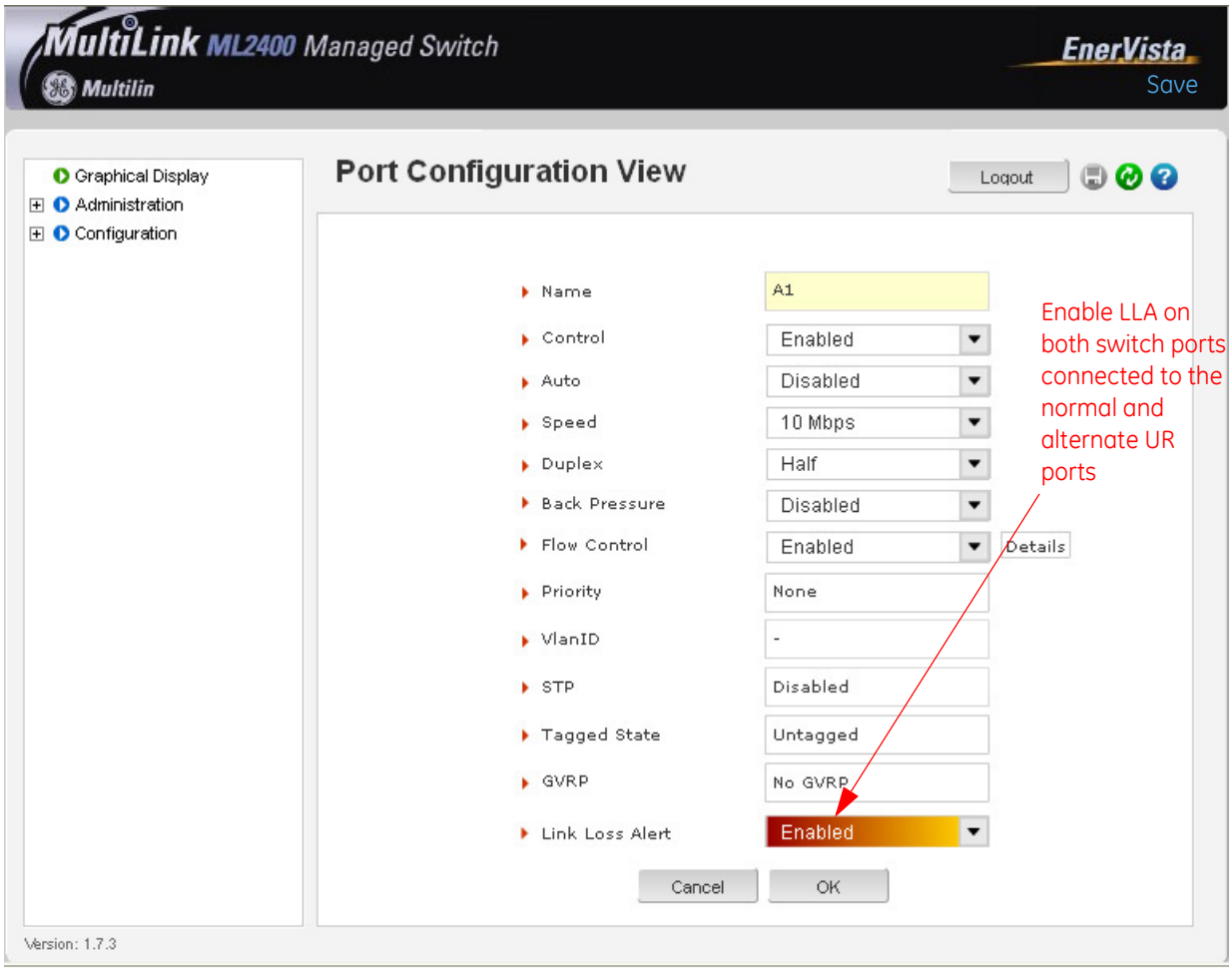
▷ Double click on the **Switch Port** icon to open the main port configuration screen.



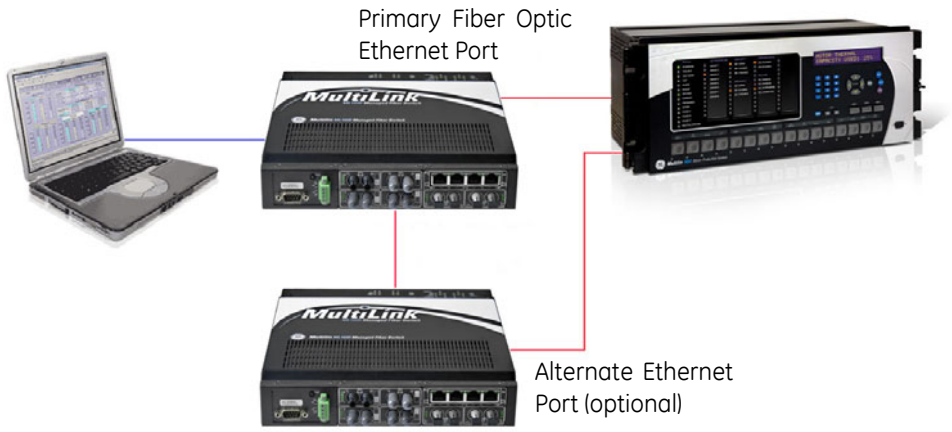
▷ Select the **Edit** icon for port number one which has the name **A1**.



- Ensure that the LINK LOSS ALTER feature is enabled on port A1.
- To save the change (if made) click on the **Save** icon.
- Repeat this procedure for the fiber optic port on the second switch..



To test the operation of the redundancy proceed as follows:



- ▷ Establish communication to one of the relays.
- ▷ Disconnect the normal port's transmit or receive fiber.
- ▷ Note that communications to the relay aren't disrupted, and check that Ethernet port diagnostics are enabled.
  The message - primarily **Ethernet Fail** - will be seen on the display.

The relay has switched over to the alternate port.

QS.5 Tagged VLAN's

VLAN is short for "Virtual LAN." A VLAN creates separate network segments that can span multiple Multilink switches. A VLAN is a group of ports designated by the switch as belonging to the same broadcast domain. VLANs provide the capability of having multiple networks co-existing on the same switch. Two advantages of VLANs are the separation of traffic and security.

VLANs can be port based or tag based. Port based VLANs assigns a specific port or group of ports to belong to a VLAN. When using tag based VLANs, a tag called a VLAN identifier is sent as part of the message. This tag allows the message to move across multiple switches whose ports are part of the same tagged VLAN.

Tagged VLANs and priority are used within IEC 61850 GOOSE messaging.

The objective of this exercise is to become familiar with the correct procedure to configure tagged VLANs within the GE Multilink switches, to support the IEC61850 GOOSE peer to peer messaging service.

Background:

The IEC 61850 Fixed GOOSE peer-to-peer communication service is an enhanced version of IEC GSSE peer-to-peer service with the additional ability of assigning a priority and what is called a "tag" to the multicast messages.

QS.5.1 Configuring Tagged VLANs

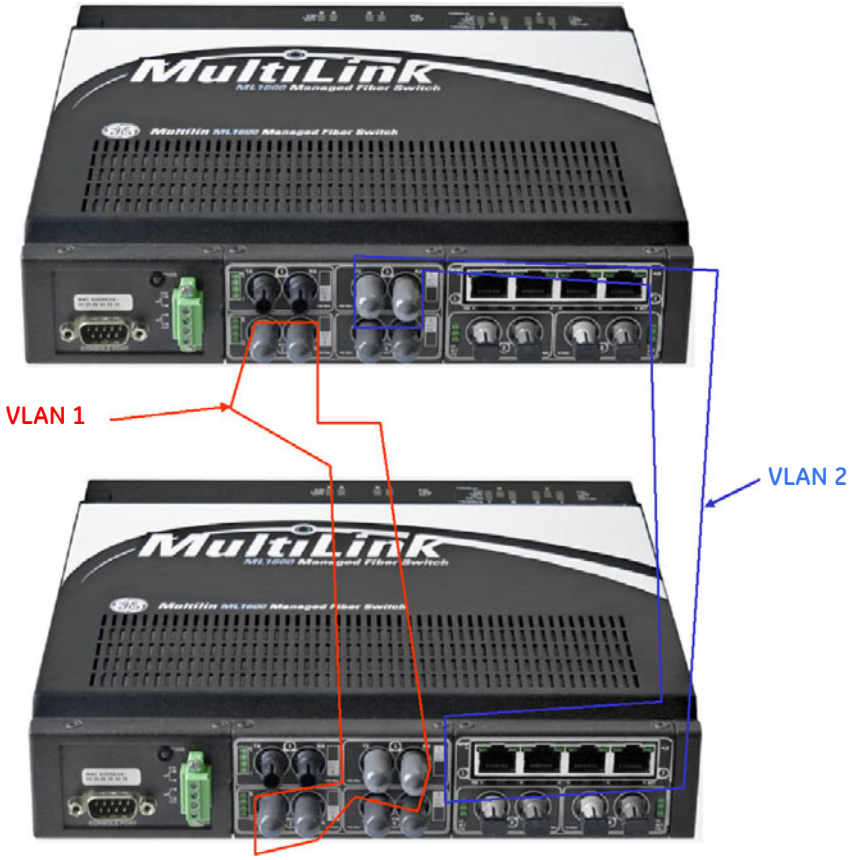
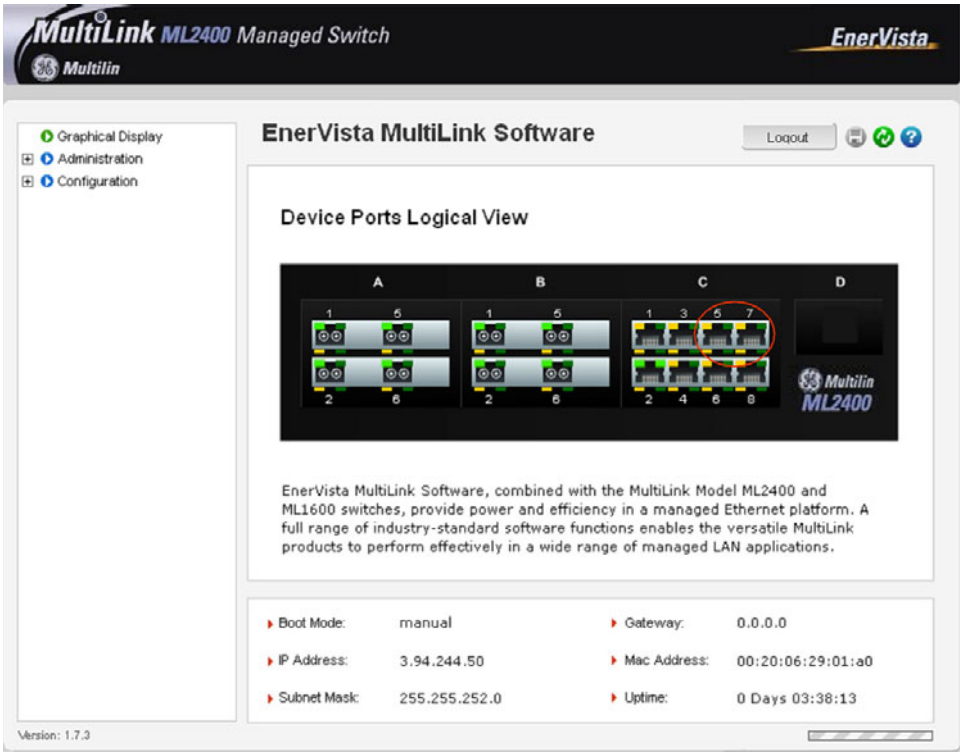


FIGURE QS–5: Tagged Virtual LANs

Configuring a VLAN within the switch

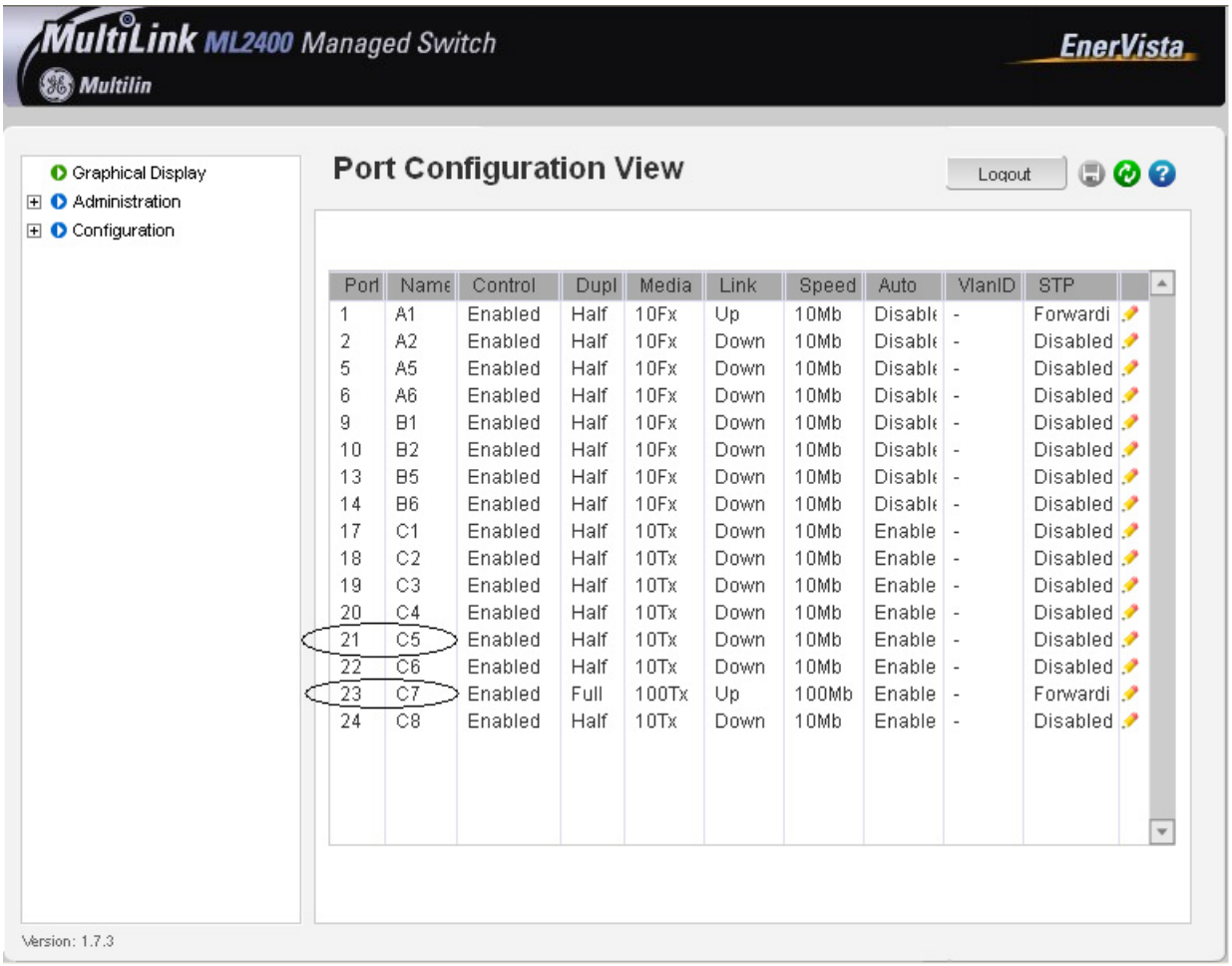
- ▷ First determine which physical ports are to be part of the tagged based VLAN.
- ▷ Take note the names of the associated ports displayed on the Multilink home page.
  In our example we want the ports named C5 and C7 to be part of the VLAN.

▷ Once the port names have been determined, open the main port configuration page by double clicking on one of the **Port** icons.



In this page we can see that the port named C5 has been assigned port number 21 and the port named C7 has been assigned port number 23. We want to assign ports 21 and 23 to their own single VLAN.

▷ Note these port numbers.



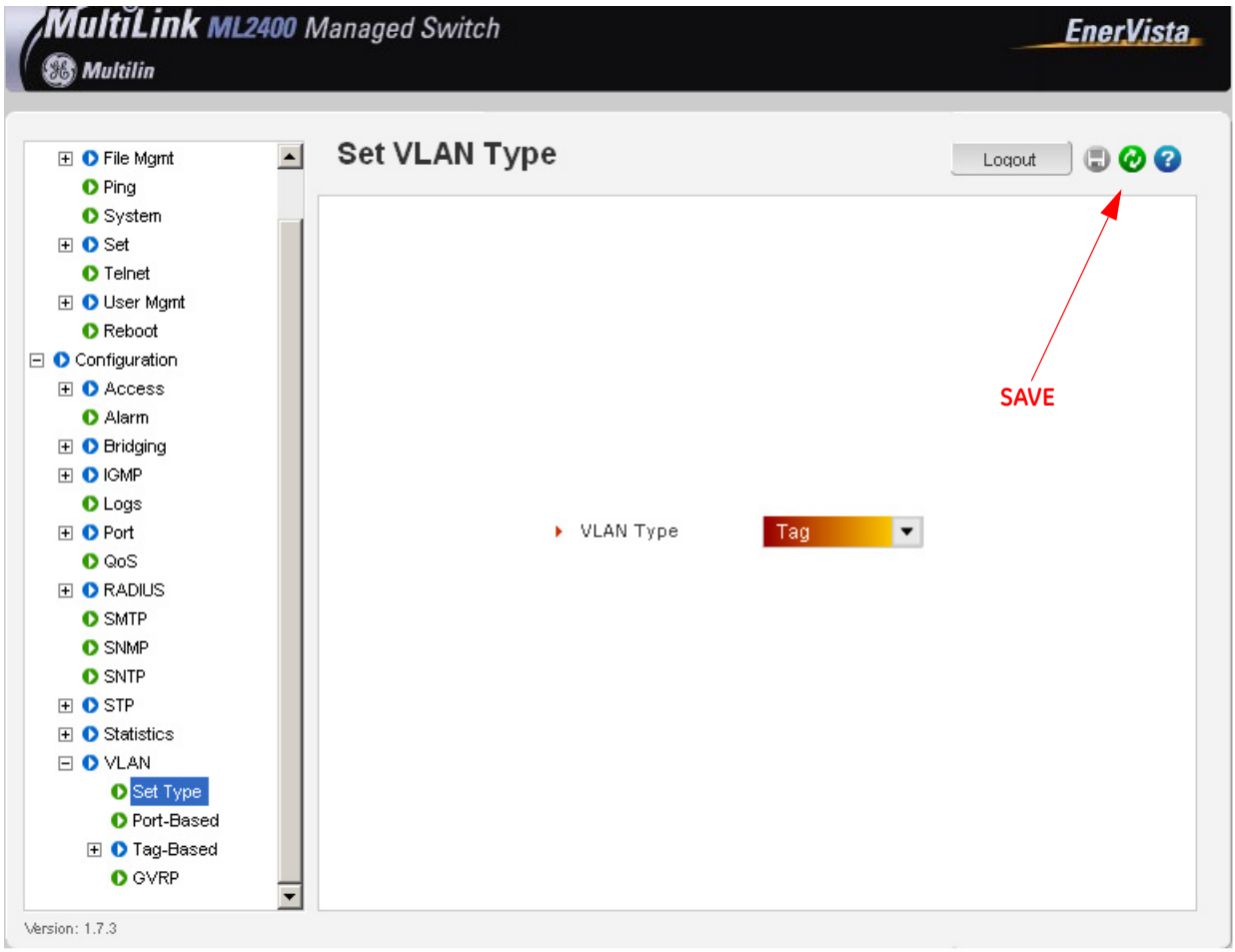
Port	Name	Control	Dupl	Media	Link	Speed	Auto	VlanID	STP
1	A1	Enabled	Half	10Fx	Up	10Mb	Disable	-	Forwardi
2	A2	Enabled	Half	10Fx	Down	10Mb	Disable	-	Disabled
5	A5	Enabled	Half	10Fx	Down	10Mb	Disable	-	Disabled
6	A6	Enabled	Half	10Fx	Down	10Mb	Disable	-	Disabled
9	B1	Enabled	Half	10Fx	Down	10Mb	Disable	-	Disabled
10	B2	Enabled	Half	10Fx	Down	10Mb	Disable	-	Disabled
13	B5	Enabled	Half	10Fx	Down	10Mb	Disable	-	Disabled
14	B6	Enabled	Half	10Fx	Down	10Mb	Disable	-	Disabled
17	C1	Enabled	Half	10Tx	Down	10Mb	Enable	-	Disabled
18	C2	Enabled	Half	10Tx	Down	10Mb	Enable	-	Disabled
19	C3	Enabled	Half	10Tx	Down	10Mb	Enable	-	Disabled
20	C4	Enabled	Half	10Tx	Down	10Mb	Enable	-	Disabled
21	C5	Enabled	Half	10Tx	Down	10Mb	Enable	-	Disabled
22	C6	Enabled	Half	10Tx	Down	10Mb	Enable	-	Disabled
23	C7	Enabled	Full	100Tx	Up	100Mb	Enable	-	Forwardi
24	C8	Enabled	Half	10Tx	Down	10Mb	Enable	-	Disabled

▷ Now open the VLANs menu and select the **Type** menu.

▷ In this menu set the VLAN type to **tag**.

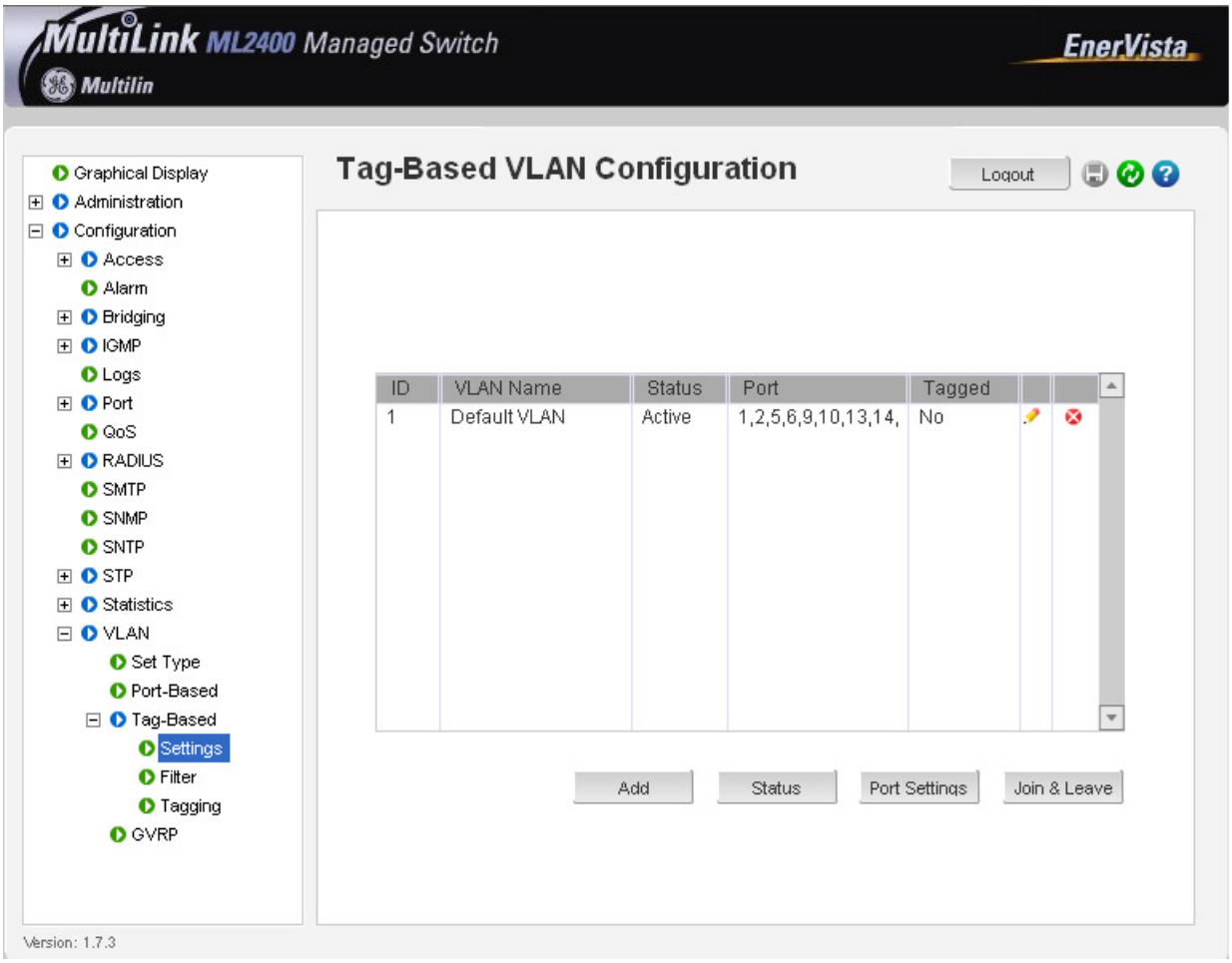
▷ Select the **Save** icon.

We have now configured the switch to support tagged based VLANs.



We can now proceed to the tagged based VLAN menu . From this menu we can see that all ports have been assigned to the default tag based VLAN 1.

▷ To create a new tag based VLAN to which to assign ports 21 and 23, first click on the **Add** pushbutton.



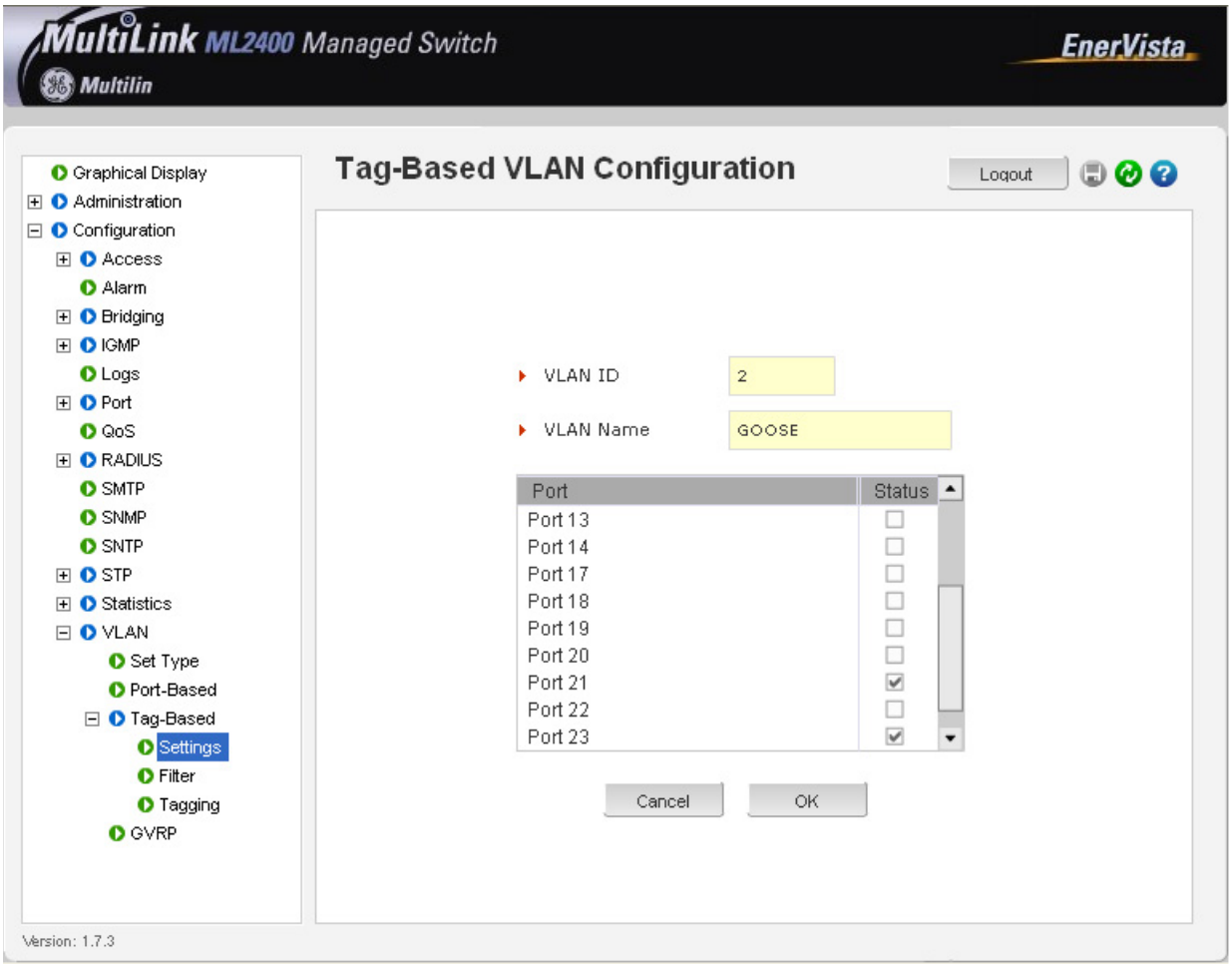
A screen will open that will allow you to configure a new tag based VLAN.

▷ Within this screen enter the new VLAN ID number (or tag) and the name of the VLAN.
We will use a tag of 2 and a VLAN name of GOOSE2.

▷ Left mouse click on the check boxes corresponding to ports 21 and 23 to add them to this new VLAN.

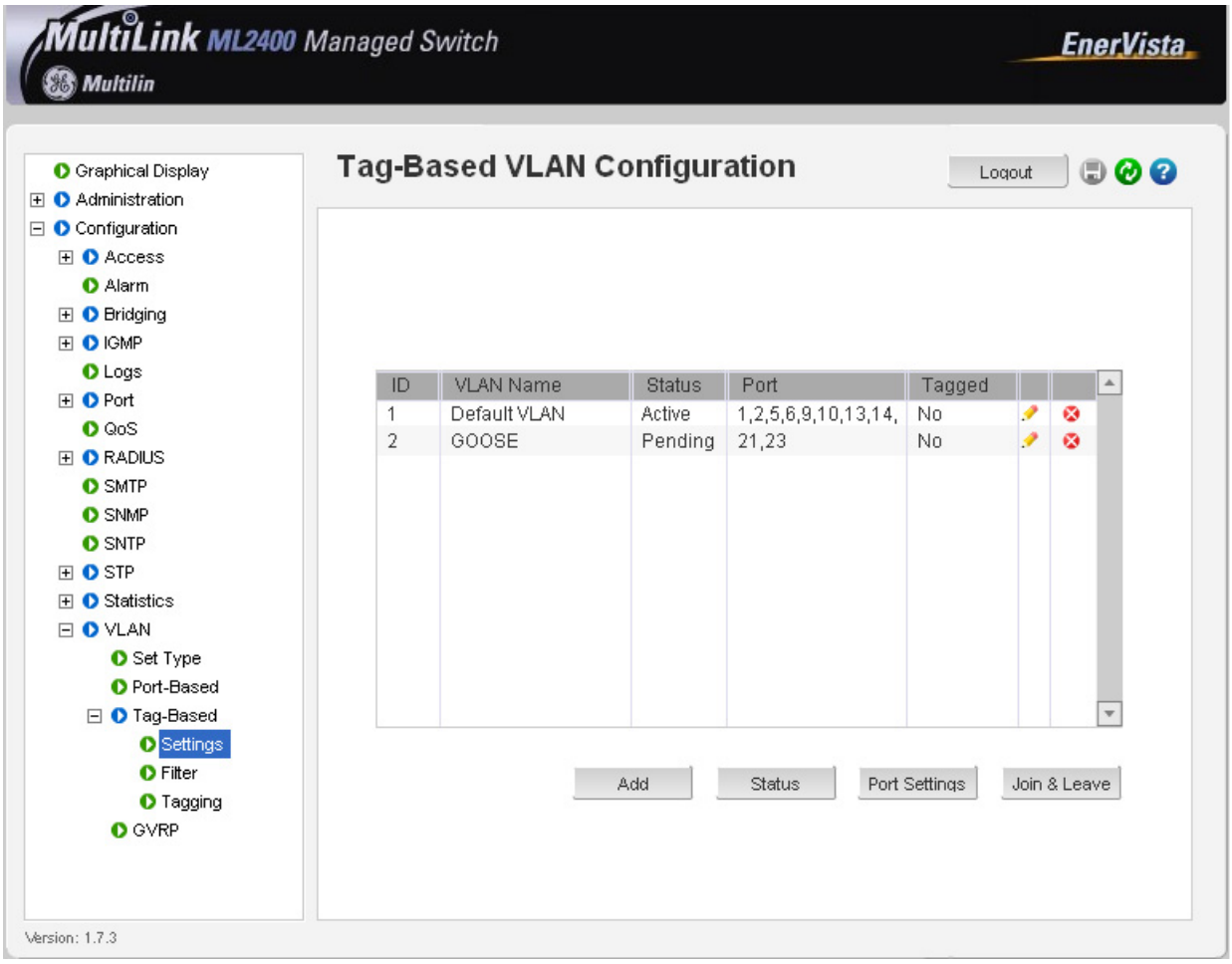
▷ Select **Save**.

▷ **OK** to exit.

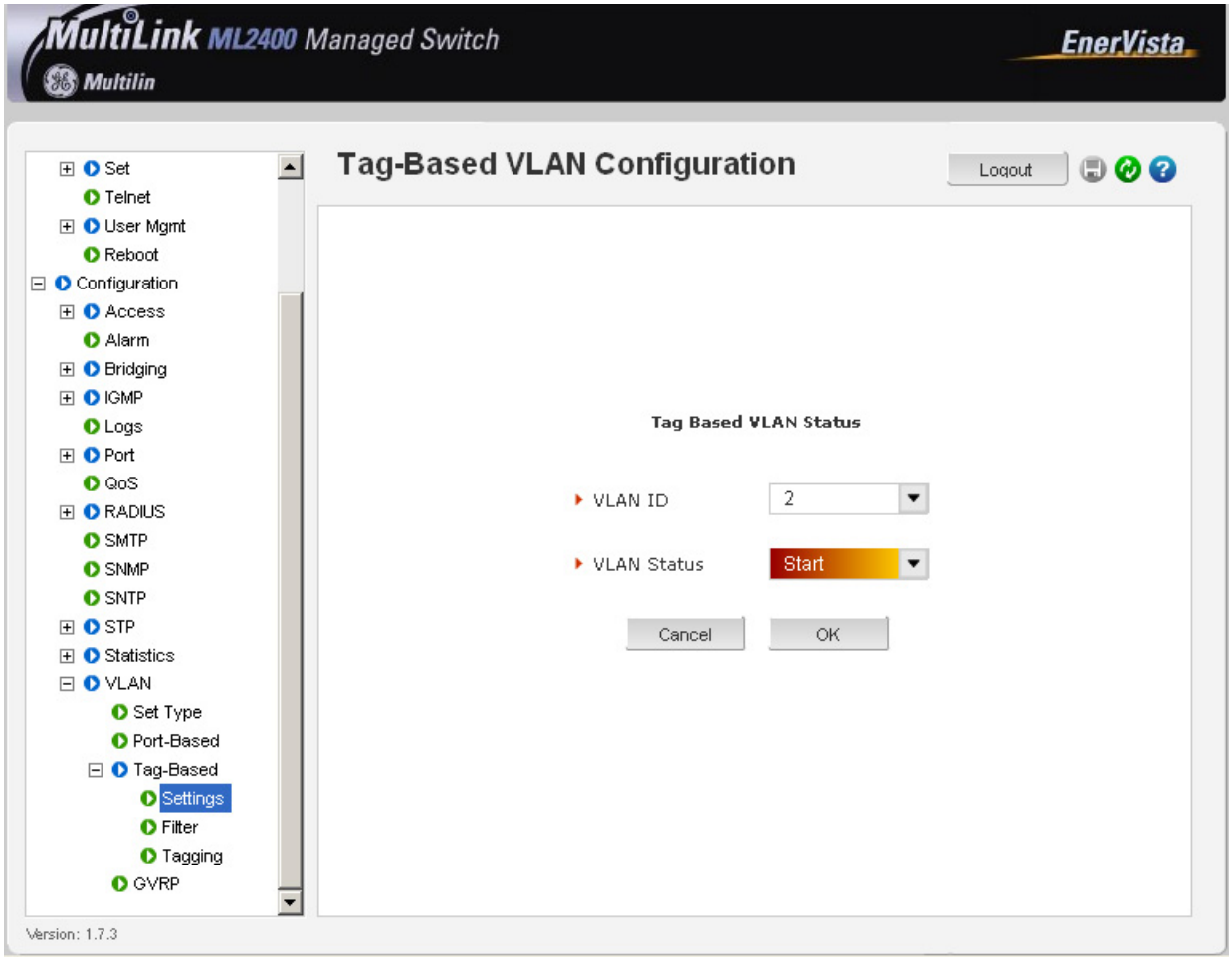


You will notice below, that the status of the VLAN named GOOSE2 is displayed as **Pending**.

To activate VLAN 2 proceed as follows.



- ▷ Select **Status**.
- ▷ Once in the Status menu, set the VLAN ID to 2 and the VLAN status to start.



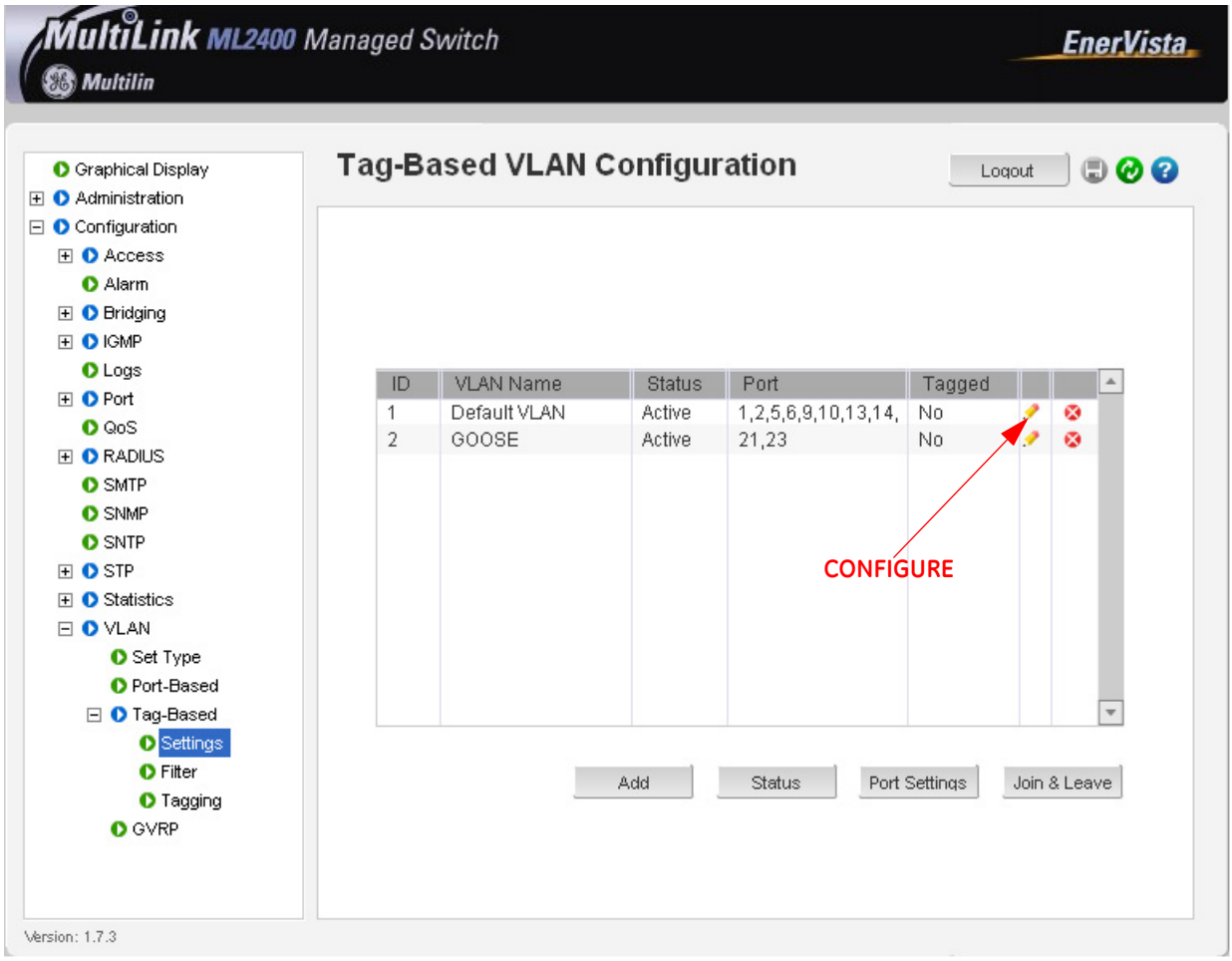
▷ **Select OK to start VLAN 2.**

You will notice that VLAN 2 is now active, and ports 21 and 23 are part of this VLAN. Ports 21 and 23 have been removed from the default tagged based VLAN1.

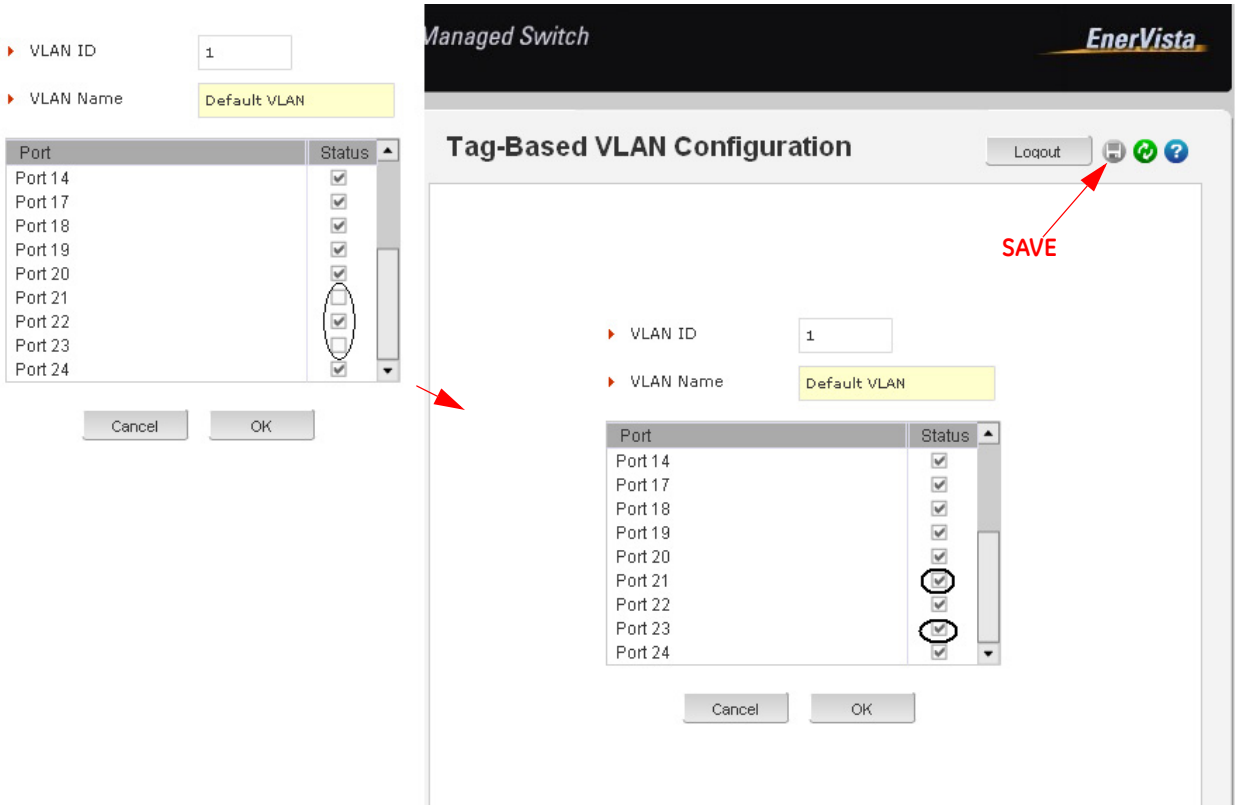
You can add ports 21 and 23 back into the default tagged based VLAN 1 if you wish, such that they are part of both VLAN 1 and VLAN 2.

To do this,

▷ **Select the configure icon for the default tagged based VLAN1.**

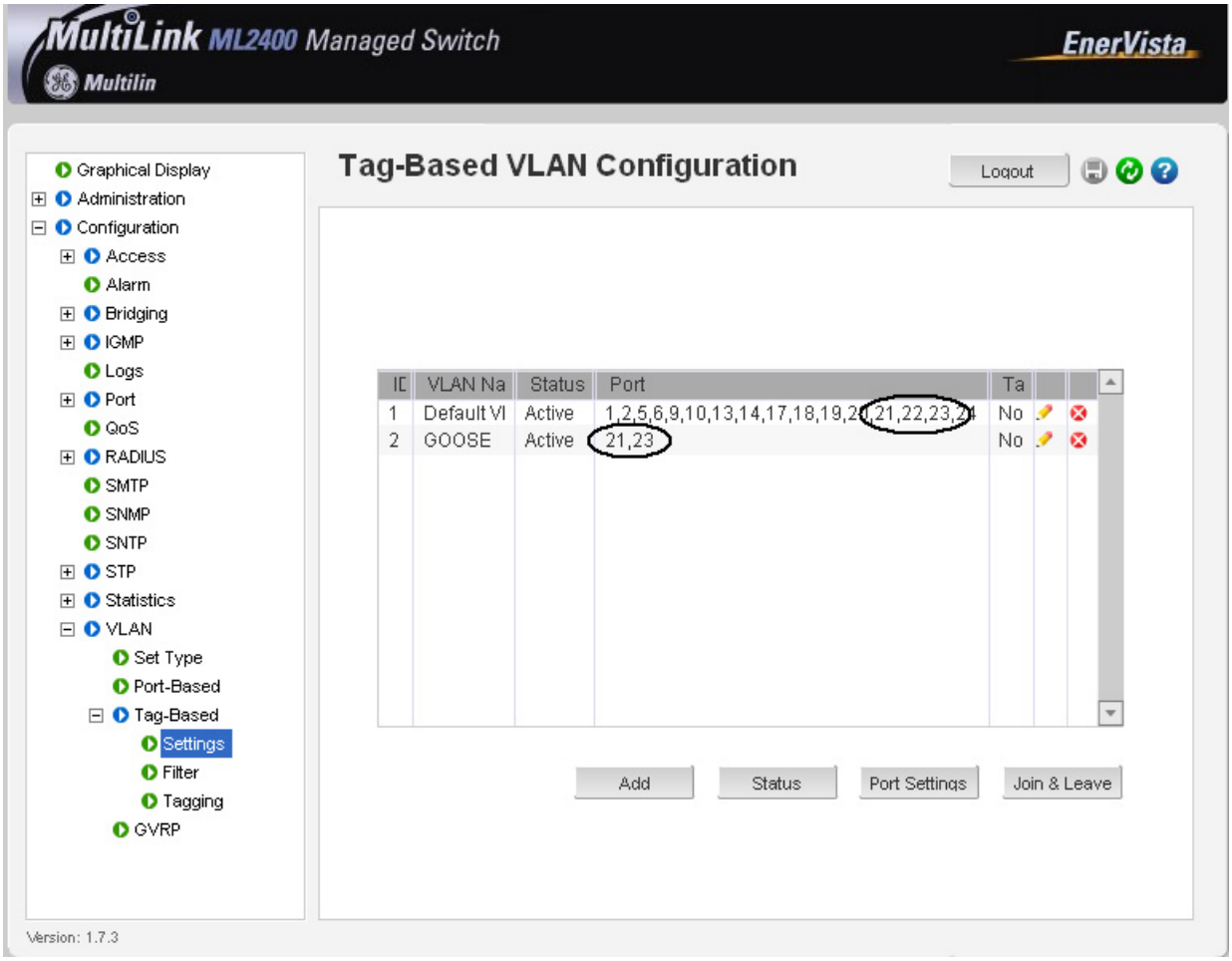

MultiLink ML2400 Managed Switch
Multilin
EnerVista
Graphical Display
Administration
Configuration
Access
Alarm
Bridging
IGMP
Logs
Port
QoS
RADIUS
SMTP
SNMP
SNTP
STP
Statistics
VLAN
Set Type
Port-Based
Tag-Based
Settings
Filter
Tagging
GVRP
Tag-Based VLAN Configuration
Logout
ID
VLAN Name
Status
Port
Tagged
1
Default VLAN
Active
1,2,5,6,9,10,13,14,
No
2
GOOSE
Active
21,23
No
CONFIGURE
Add
Status
Port Settings
Join & Leave
Version: 1.7.3

▷ Add ports 21 and 23 to tagged based VLAN 1 by checking the corresponding boxes.



▷ Select the **save** icon at the top of the screen.

▷ Select **OK** to return to the main tag VLAN menu.



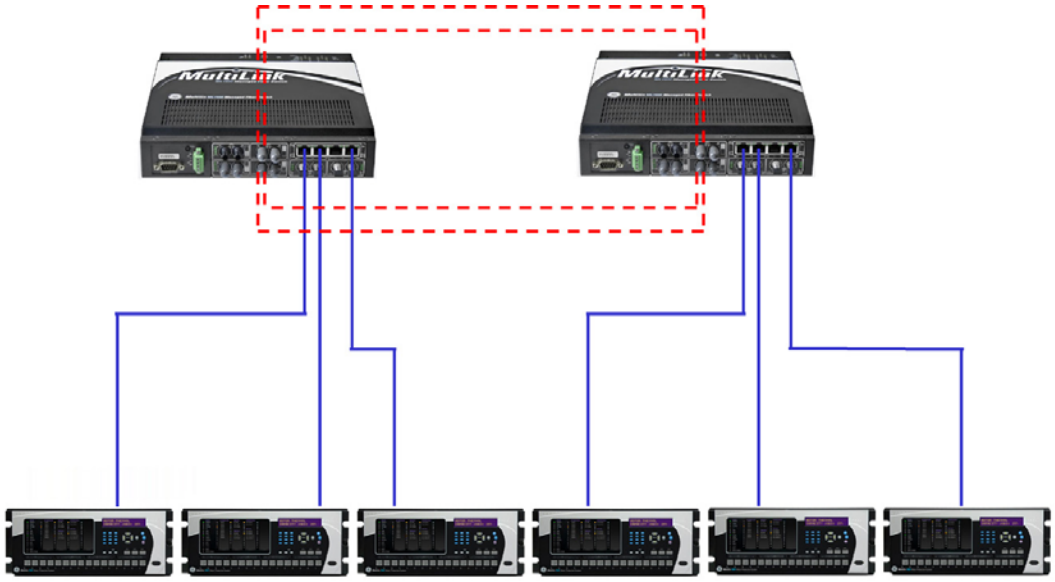
Note that ports 21 and 23 are now part of both VLAN1 and VLAN 2.

You have now completed the exercise.

QS.5.2 Configuring the Multilink switch for Ring Only Mode

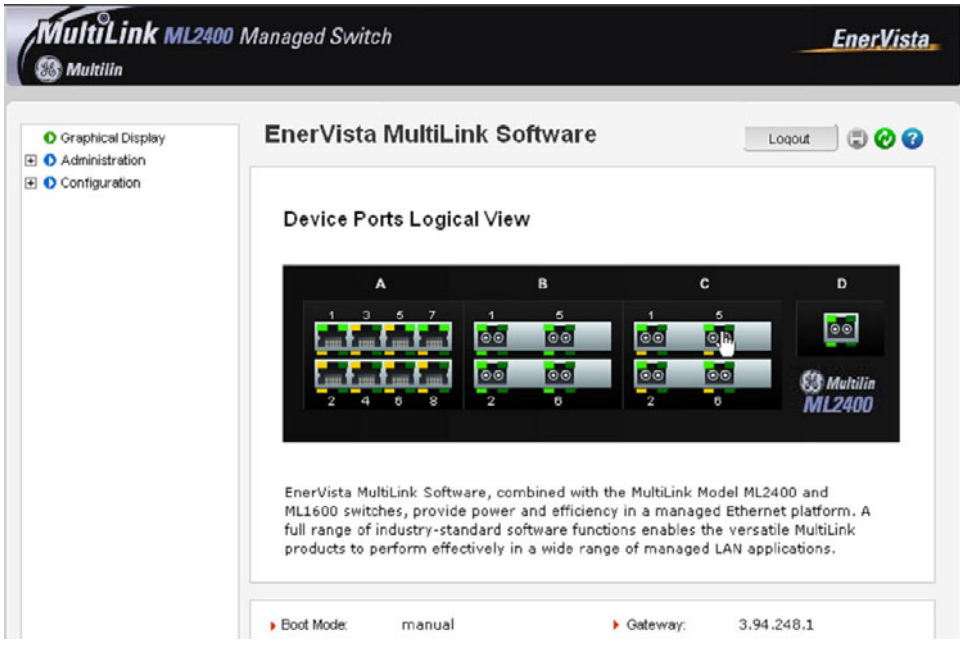
This feature can be only be used when the switches are connected to form a single ring topology which means that only two ports per switch are used to form the ring and all other ports will not be part of another ring. Note that RSTP and Ring-only mode support a maximum of 18 switches. RO mode has typical recovery time of ≤ 5 ms/hop.

▷ Determine which ports on each switch will be used to create the ring.



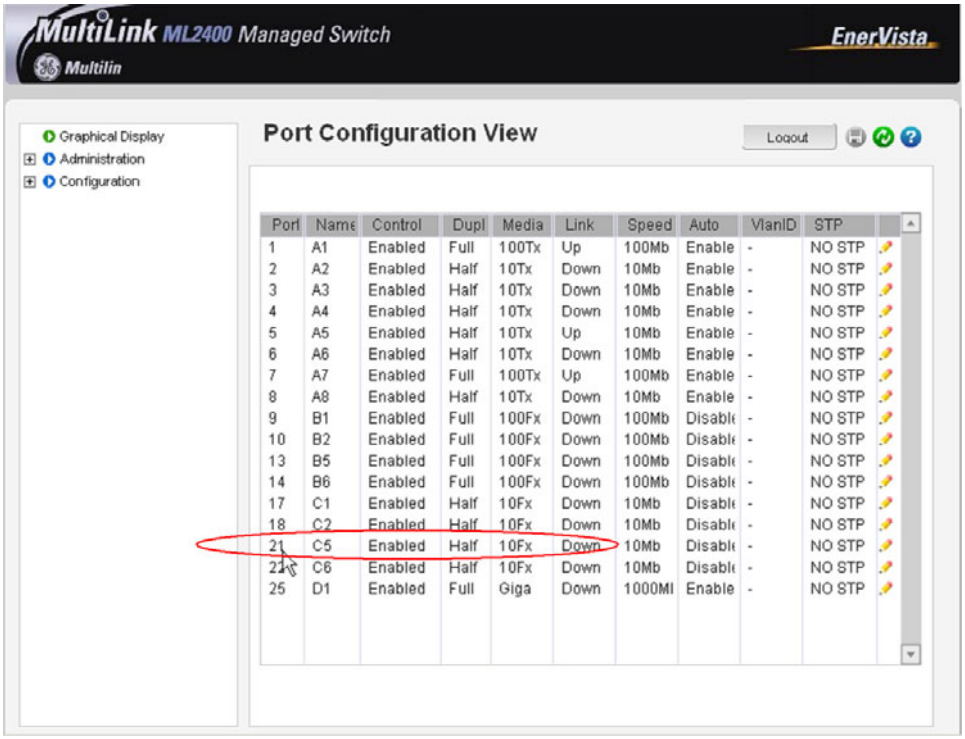
In this example it has been determined that the port named C5 will be one of the ports forming the ring.

▷ Click on the port C5 to open the main port configuration screen.



From this screen we can see that the port named C5 is actually port 21.

▷ Note this port number.



Port	Name	Control	Dupl	Media	Link	Speed	Auto	VlanID	STP
1	A1	Enabled	Full	100Tx	Up	100Mb	Enable	-	NO STP
2	A2	Enabled	Half	10Tx	Down	10Mb	Enable	-	NO STP
3	A3	Enabled	Half	10Tx	Down	10Mb	Enable	-	NO STP
4	A4	Enabled	Half	10Tx	Down	10Mb	Enable	-	NO STP
5	A5	Enabled	Half	10Tx	Up	10Mb	Enable	-	NO STP
6	A6	Enabled	Half	10Tx	Down	10Mb	Enable	-	NO STP
7	A7	Enabled	Full	100Tx	Up	100Mb	Enable	-	NO STP
8	A8	Enabled	Half	10Tx	Down	10Mb	Enable	-	NO STP
9	B1	Enabled	Full	100Fx	Down	100Mb	Disable	-	NO STP
10	B2	Enabled	Full	100Fx	Down	100Mb	Disable	-	NO STP
13	B5	Enabled	Full	100Fx	Down	100Mb	Disable	-	NO STP
14	B6	Enabled	Full	100Fx	Down	100Mb	Disable	-	NO STP
17	C1	Enabled	Half	10Fx	Down	10Mb	Disable	-	NO STP
18	C2	Enabled	Half	10Fx	Down	10Mb	Disable	-	NO STP
21	C5	Enabled	Half	10Fx	Down	10Mb	Disable	-	NO STP
22	C6	Enabled	Half	10Fx	Down	10Mb	Disable	-	NO STP
25	D1	Enabled	Full	Giga	Down	1000MI	Enable	-	NO STP

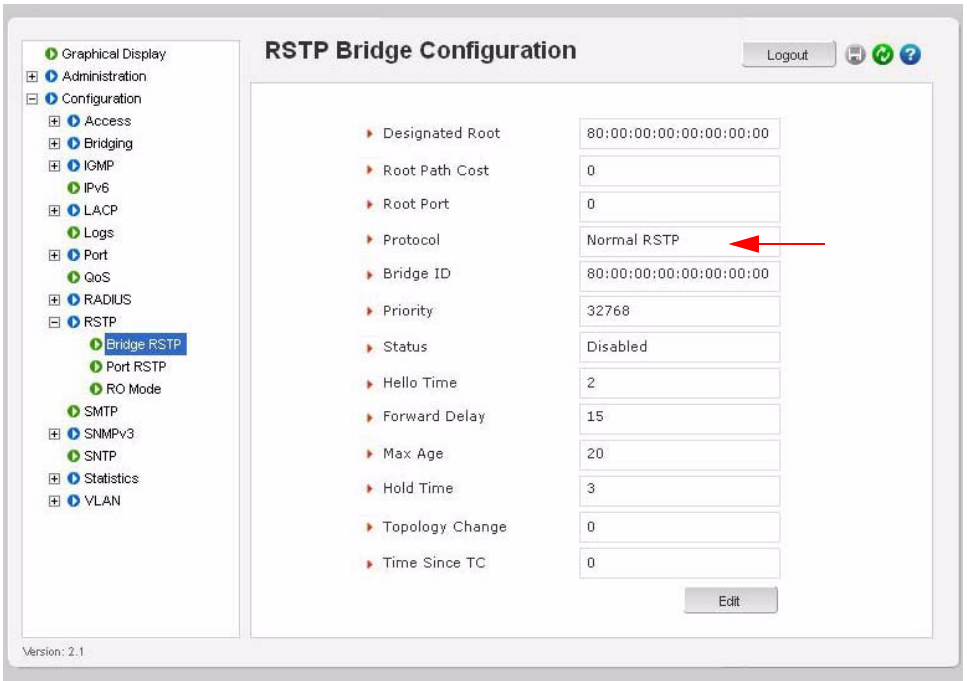
▷ from the Administration menu open the **Set** menu.

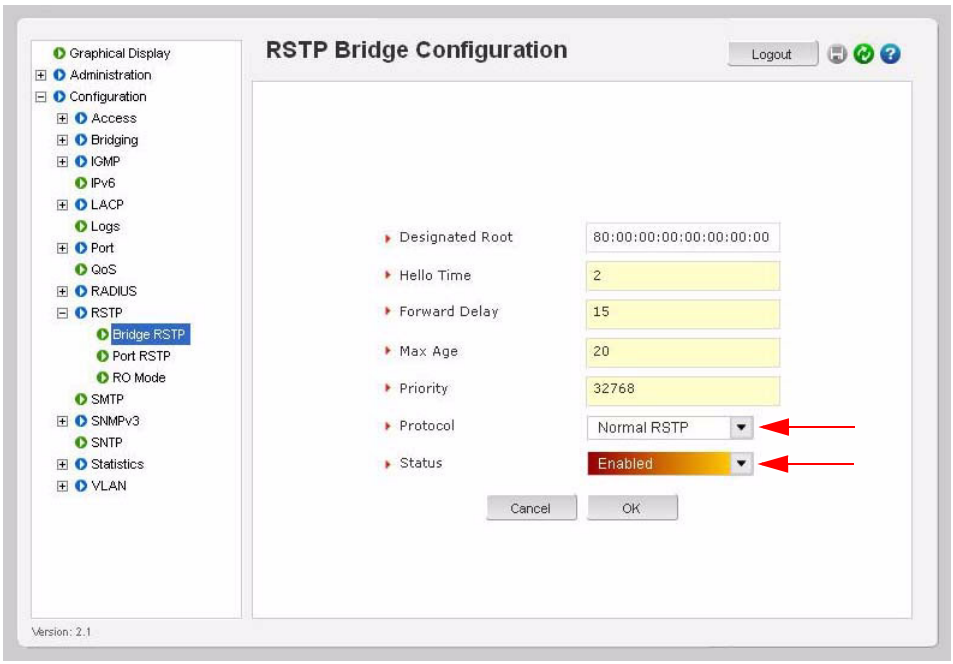
▷ Open the **STP type** setting.

▷ Set STP to Rapid Spanning Tree (**RSTP**).

▷ **Save** the setting.

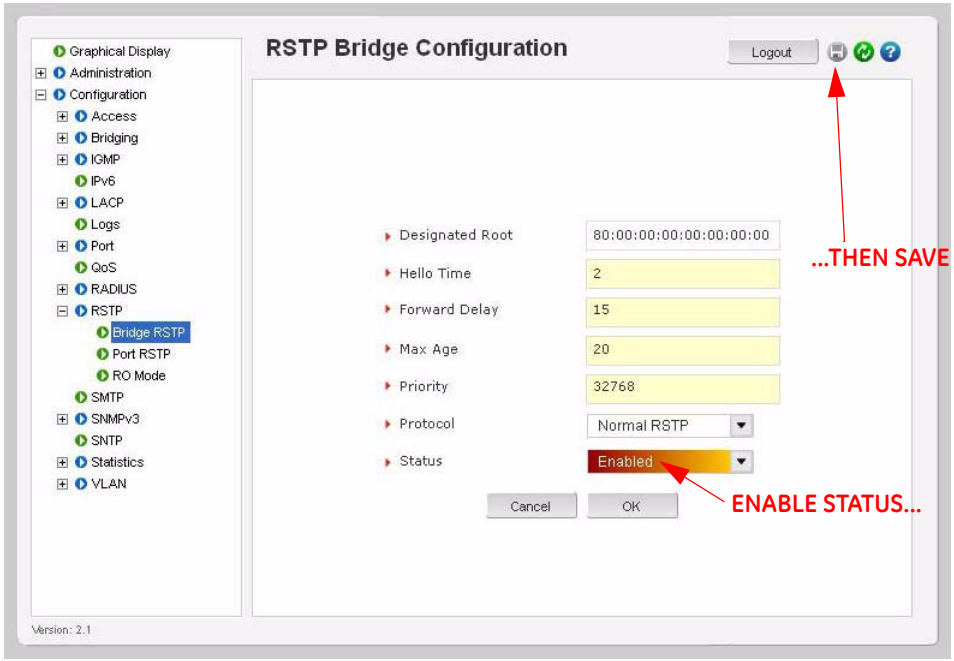
- From the configuration menu open the **RSTP** menu.
- Select **Bridge RSTP**.
  Note that the protocol is still set to **normal RSTP**.
- Select the **Edit** icon.



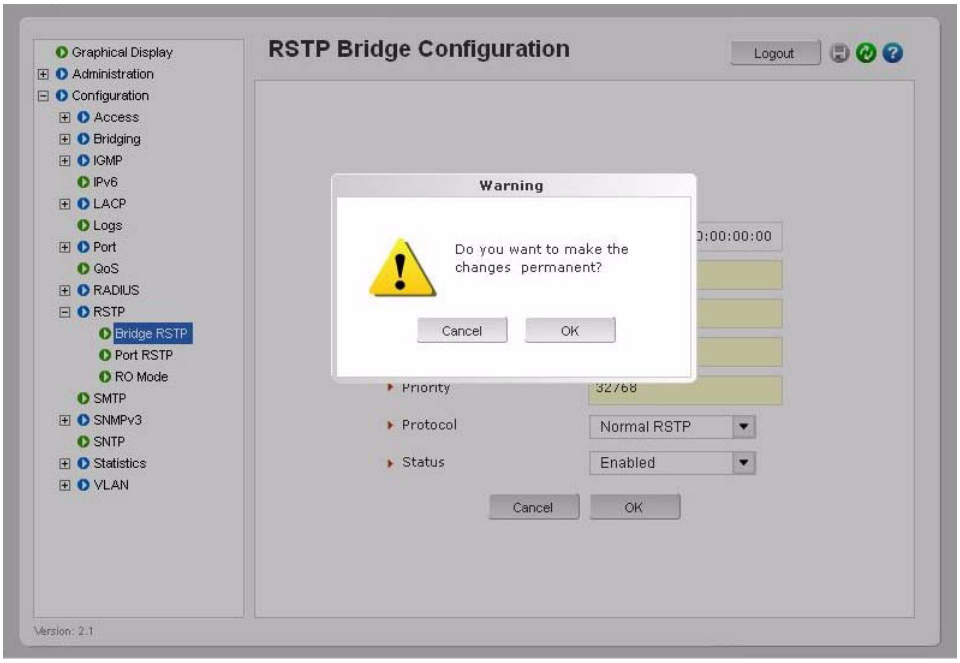


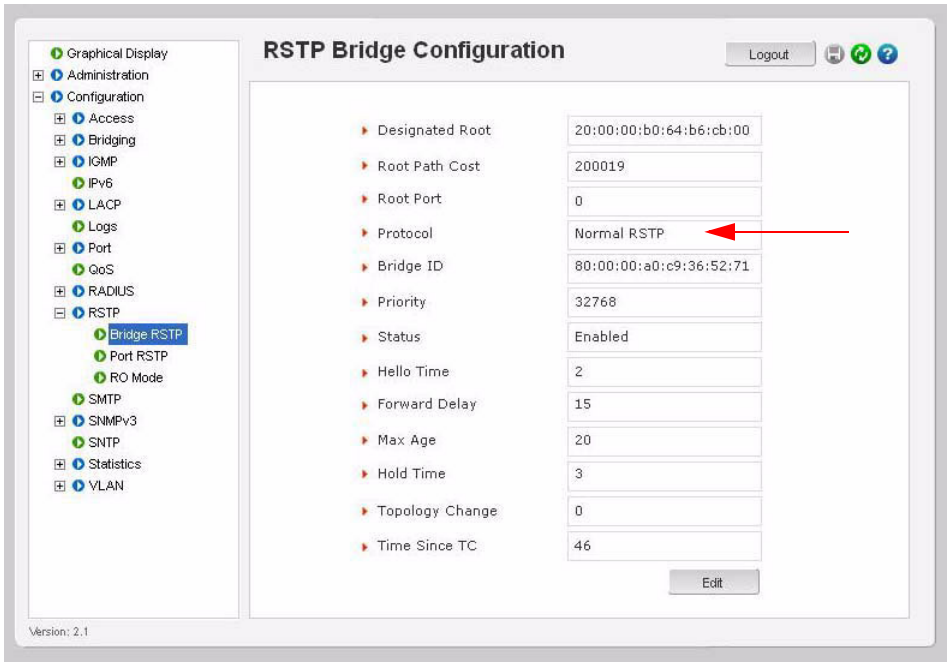
▷ Once in **Edit** mode, change the **Status** to **Enabled**

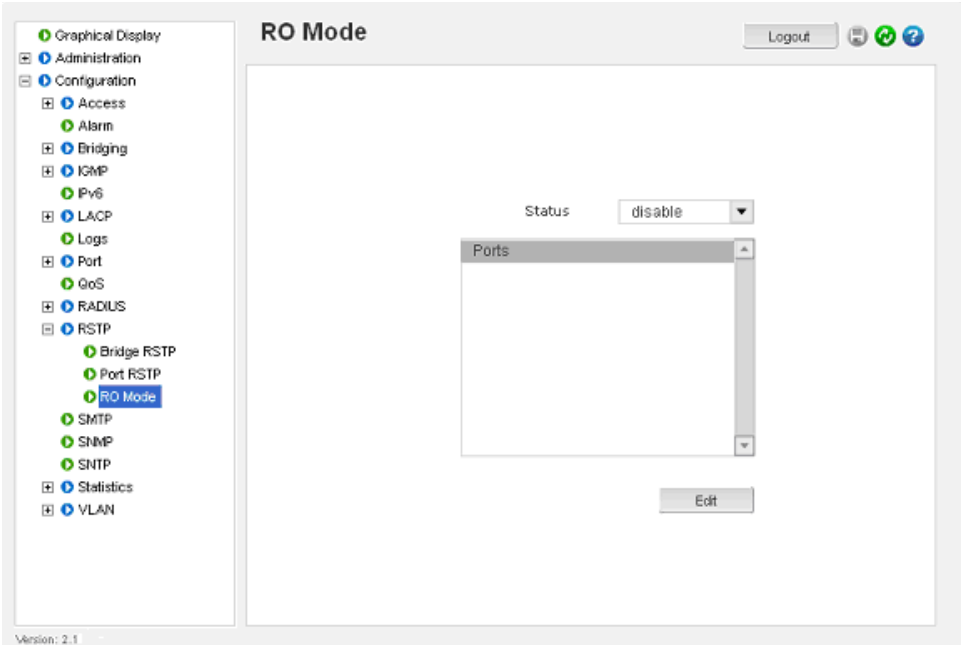
▷ Once these settings have been completed **Save** the configuration.



▷ Once saved, select **OK**, then **OK** again to exit.



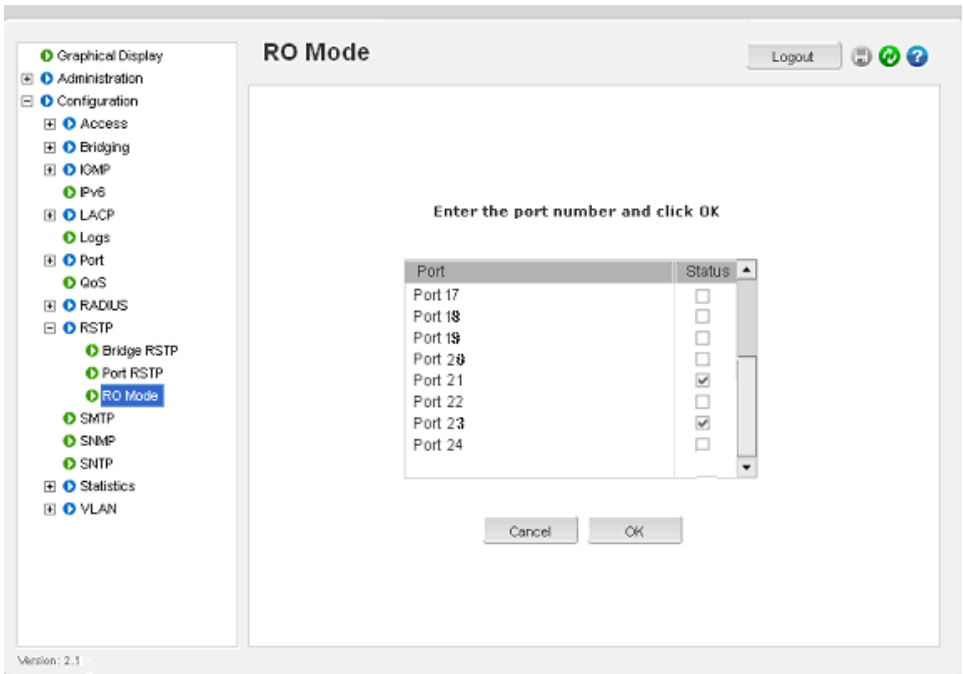




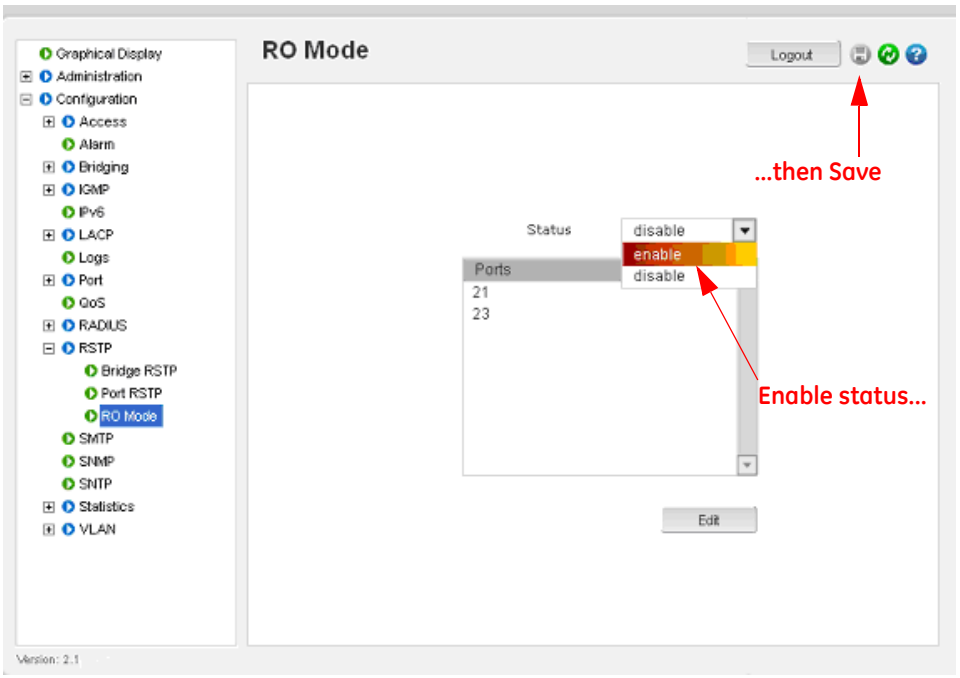
- ▷ Select the **Configuration > RSTP > RO Mode** menu as shown above.
- ▷ Click the **Edit** button to configure RO Mode.
- ▷ Select the desired ports that are part of the ring, as shown below.
- ▷ Click **OK** to exit.

NOTE

Only 2 ports can be selected to Ring Only Mode.



▷ Select the **Enabled** option for the Status setting as shown below.

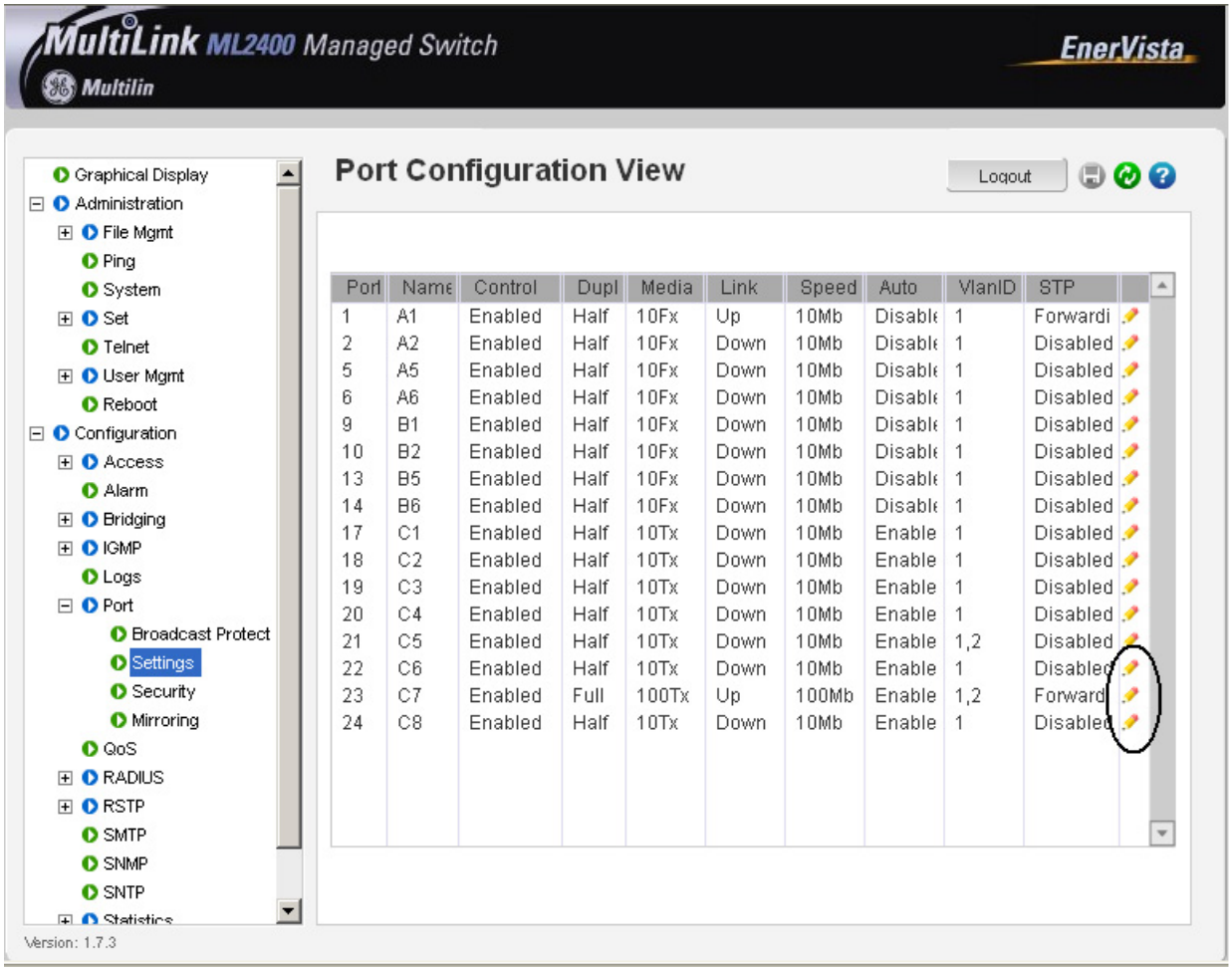


▷ Change status to **Enable**.

▷ Save the configuration by clicking on the  icon.

For proper recovery, disable the **Link Loss Alert** function on the port named C5 (port21) as follows:

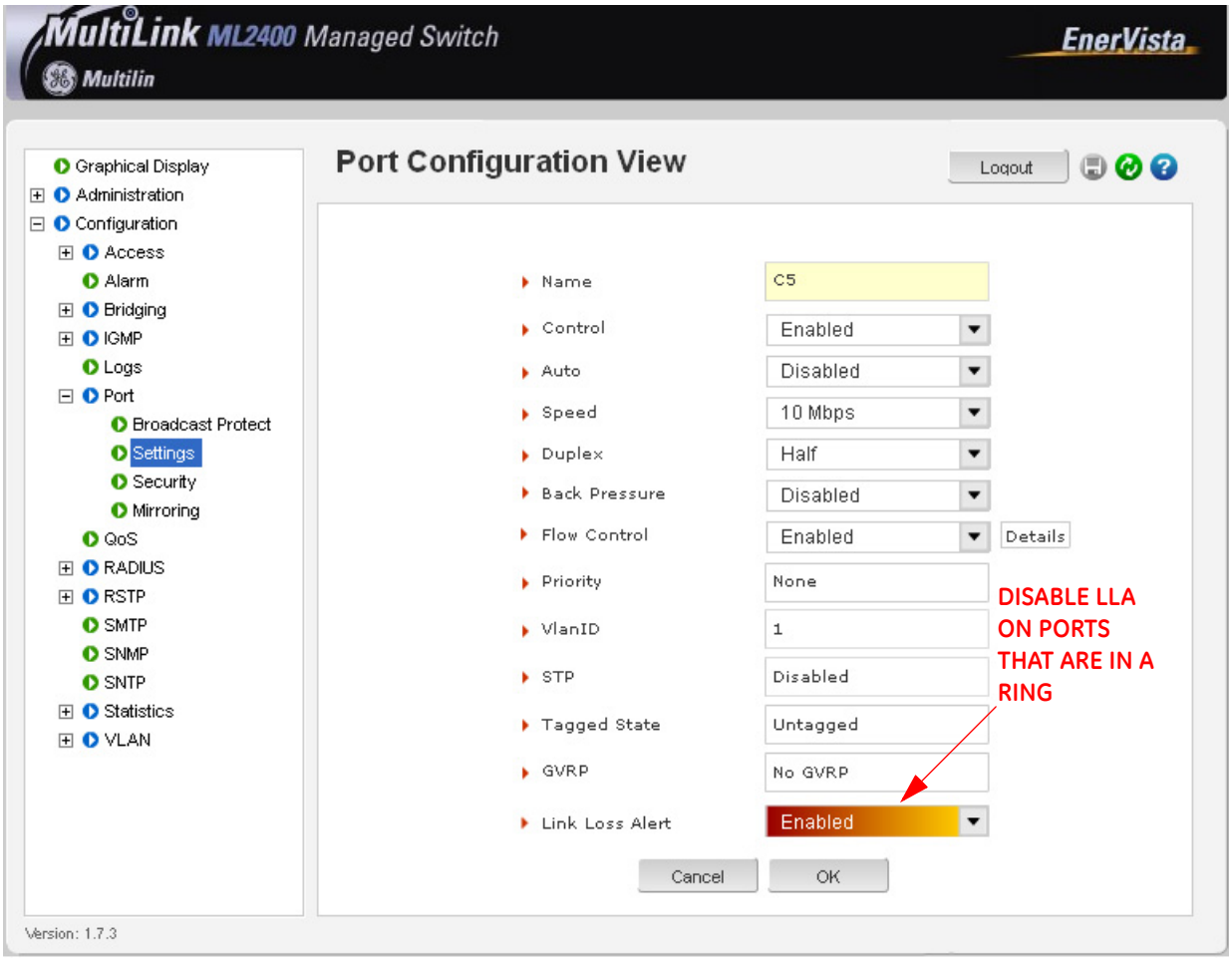
▷ From the main port configuration menu, left mouse click on the **Configuration** icon for port 21.



▷ Within port 21's configuration screen set the Link Loss Alert to **Disabled**.

▷ **Save** the settings.

▷ Repeat this procedure for the other port on this and the rest of the switches that form the ring.



▷ Once this procedure has been completed for all ports forming the ring, connect the configured ports into the ring topology as shown below.

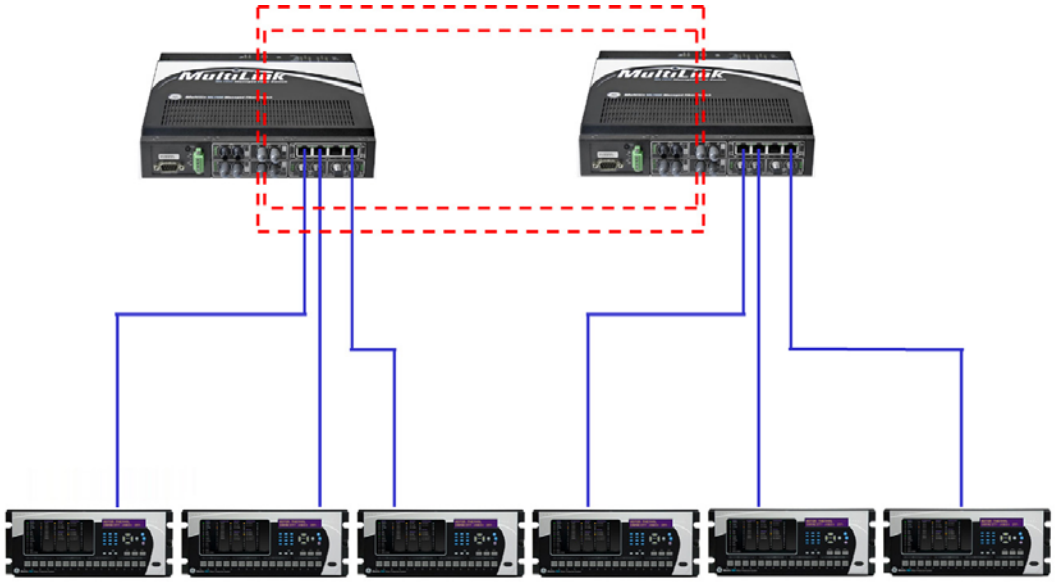


FIGURE QS–6: Configuration of the MultiLink ring Only mode

You have completed the exercise.

QS.6 ML1600/2400 Firmware Updates

QS.6.1 Updating MultiLink Firmware

This section describesthe process for upgrading the firmware on a GE Multilink Ethernet switch. The methods describe updating the Multilink firmware either locally using the console port or remotely over the network using FTP or TFTP.

The following equipment and software are required for loading the Multilink Ethernet switch with the new firmware version.

1. A female-to-female null modem cable. (This is only necessary when upgrading using the Multilink console port.)
2. PC serial port. If your PC does not have a serial port, a USB-to-serial converter will be required. (This is only necessary when upgrading using the Multilink console port.)
3. A PC (or a workstation/computer) with a terminal emulation program such as Huyperterminal (included with Windows) or Teraterm-pro or other equivalent software. Verify that the software supports Xmodem protocol.
4. Enough disk space to store and retrieve the configuration files as well as a copy of the Multilink firmware. We recommend at least 15 MB of free disk space.
5. Manager level account name and password for the switch being upgraded.
6. An internet connection. Ensure the connection does not block ftp file transfers

QS.6.2 Selecting the Proper Version

The latest version of the firmware is available at:

http://www.GEmultilin.com/catalog/ethernet.htm.

To determine the version of firmware currently installed on your switch, do the following:

- ▷ **Using the command line interface, log into the switch uwing Manager access rights.**
- ▷ **In the command line prompt, enter the command, show version.**
- ▷ **Using the EnerVista web interface, enter the IP address of the switch in the address bar of a web browser**
  The firmware version installed on the switch will appear in the lower left corner of the screen.

QS.6.3 Upgrading Using a Serial Connection- Command Line Interface

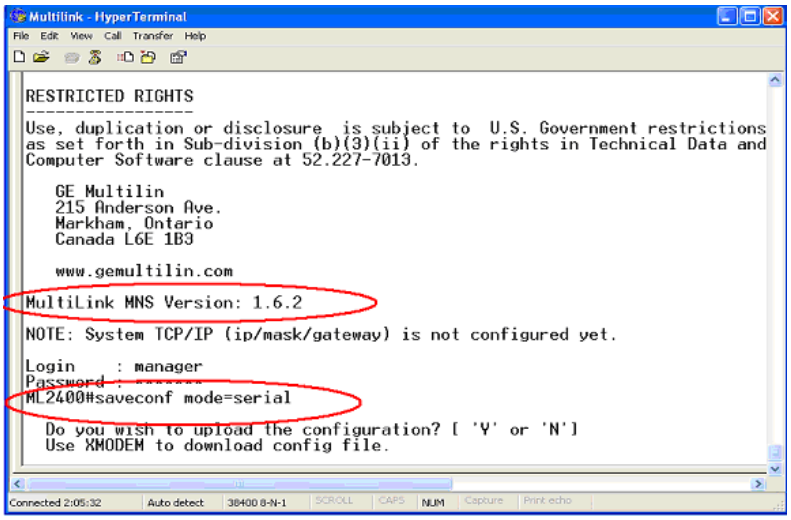
Use the following procedure to install firmware to the ML1600/2400 via the serial port.

- ▷ **Download the MultiLink Switch Software from the GE Multilin web site, to a convenient location on your hard drive.**
- ▷ **Use the null-modem cable to connect to the serial port of the switch.**

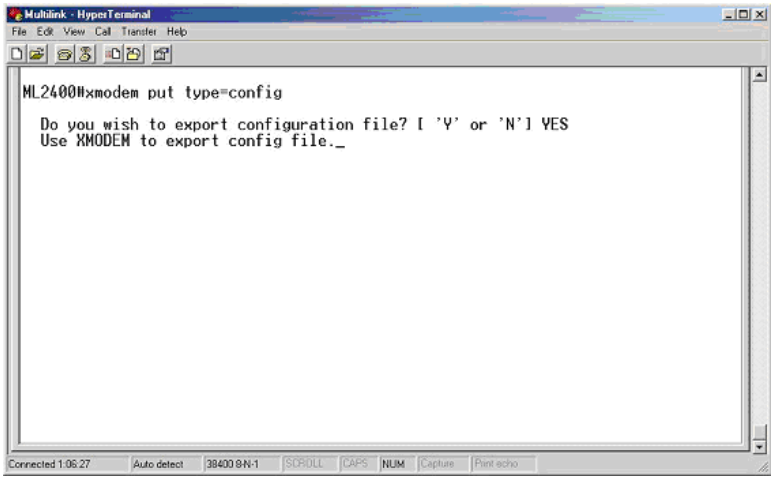
▷ Login at the **manager** level with the proper password.

It is recommended that you save the current switch configuration before upgrading the firmware.

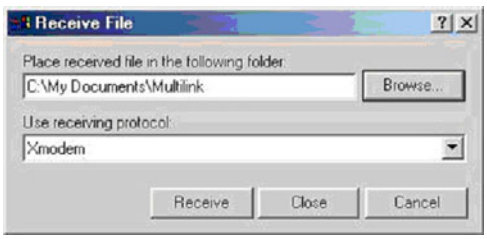
▷ If the current firmware is older than 1.7.3, use the **saveconf** command as shown below:



▷ If the current firmware is 1.7.3 or above, enter the **xmodem** command as shown below:



▷ Click on the **Transfer** menu item and choose the **Receive File** option.



- ▷ Enter the path to the folder in which the configuration file will be stored
- ▷ Select Xmodem as the receiving protocol.

- ▷ Enter a name for the configuration file.
- ▷ Click **OK**.
  The configuration file will be stored at the specified location.
- ▷ Verify that the configuration file has been created and stored correctly.

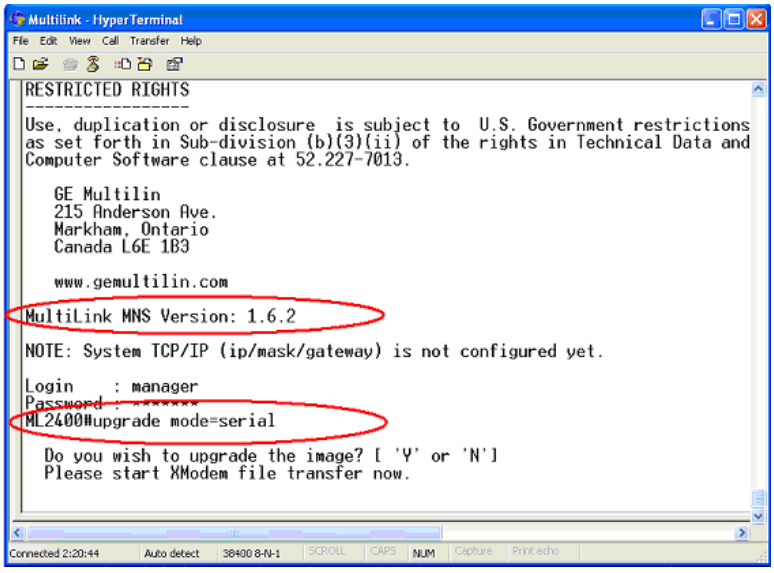
This completes the Save (original) Configuration procedure.

The following procedure describes how to upgrade the firmware:

- ▷ If the current firmware is older than 1.7.3, use the **upgrade** command:

```
ML1600/2400# upgrade mode=serial
Do you wish to upgrade the image? [Y or N]  Y
```

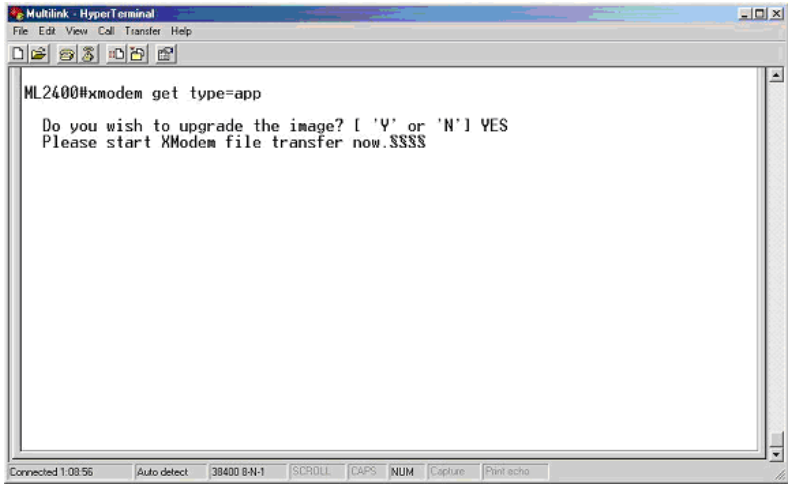
See figure below.



- ▷ If the current firmware is older than 1.7.3, use the **xmodem** command:

```
ML1600/2400# Xmodem get type=app
```

```
                    Do you wish to upgrade the image? [Y or N]  Y
```

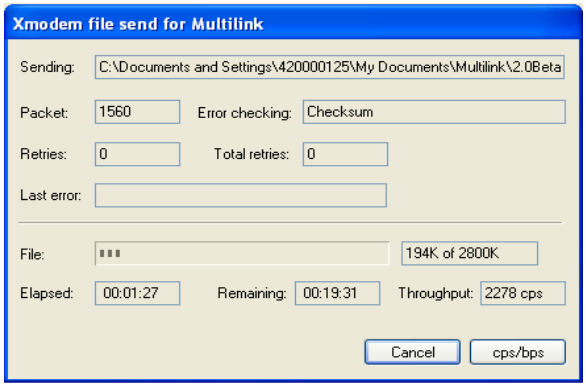


▷ Select the **Transfer** menu item and choose the **Send File** option

▷ Enter the location of the firmware file that has to be loaded into the switch.

▷ Select **Xmodem** as the protocol.

▷ Click on the **Send** button.
The file will start to load as shown below.



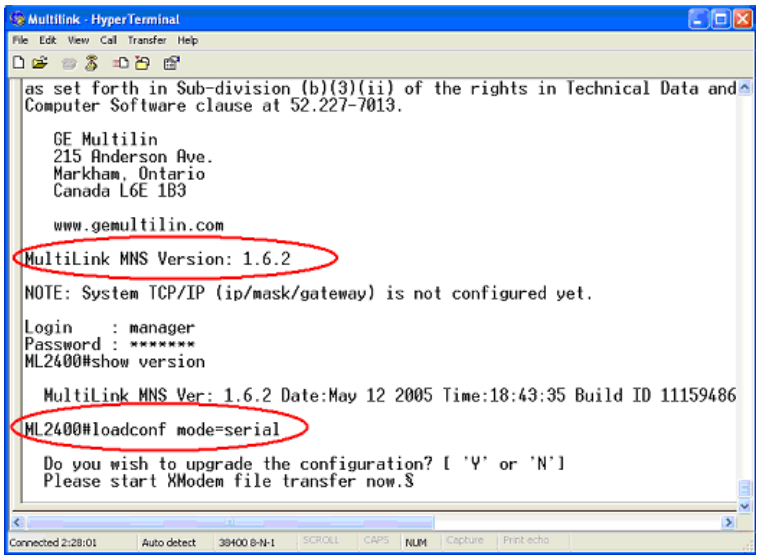
▷ Once the file transfer is complete, reboot the switch using the **Reboot** command, or by switching the power off then on.

```
ML1600/2400# reboot
   Proceed on rebooting the switch? [Y or N] Y
Rebooting now...
```

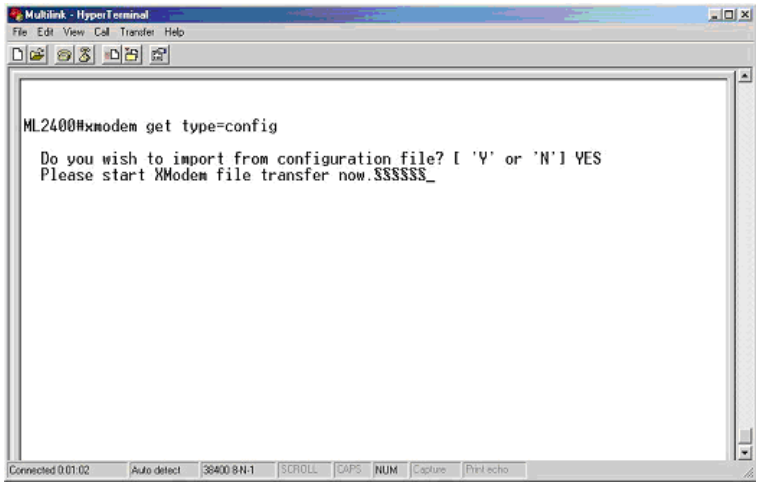
▷ Login to the switch and use the **show version** command to verify the version.

```
ML1600/2400# show version
```

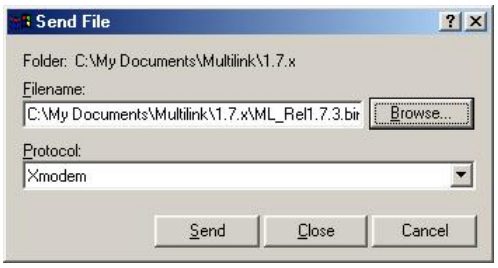
▷ If necessary, upload the configuration file using the following commands.
If the current firmware is older than 1.7.3, use the **loadconf** command as shown below:



▷ If the current firmware is older than 1.7.3, enter the **xmodem** command as shown below:

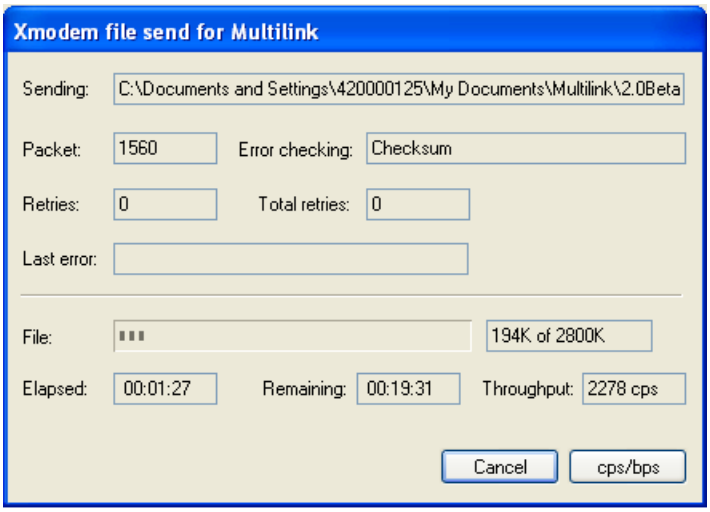


▷ Select the Transfer menu item and choose the **Send File** option.



▷ Enter the location of the configuration file and select Xmodem for the protocol.

▷ Click on the Send button.
The file will start to load as shown below:



▷ Once the transfer is complete, the switch will have to be rebooted either by entering **Reboot** or by switching the power off then on.

```
ML1600/2400# reboot
   Proceed on rebooting the switch? [Y or N] Y
Rebooting now...
```

▷ Once the switch has rebooted, login and verify that the configuration was loaded correctly.

This completes the upgrade process.

QS.6.4 Updating Using the EnerVista Web Interface Software

Use the following steps to install the EnerVista Secure Web Management software.

▷ Download the latest MultiLink firmware from the GE Multilin web site to a convenient location on your hard drive.

- Ensure that you have an FTP or TFTP server installed and running on your computer. If you are using FTP, make sure you have the FTP login name and password information ready.
- Select the switch to upgrade. Ensure you have system administration rights and privileges available on that switch.
- Open a SWM session with the switch by typing in the following URL:

  https://<IP address of the switch>

Using FTP

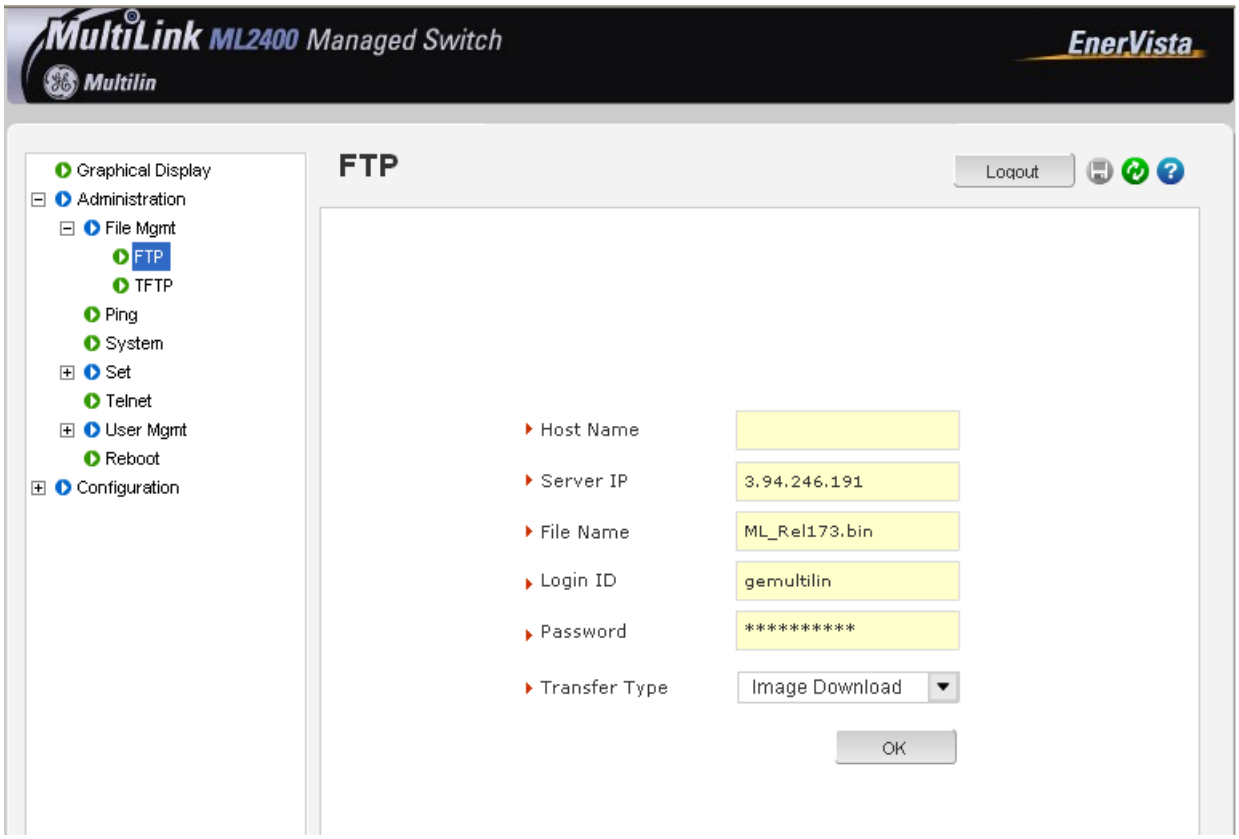
It is always a good idea to save the configuration before an upgrade. GE Multilin recommends a two-step update: first save the configuration to the ftp server, then load the new image and restart the switch.

To save the configuration using FTP,

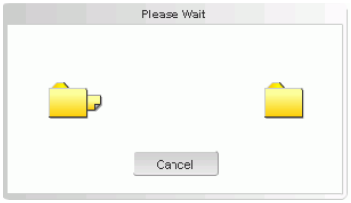
- Select the **Config Upload** transfer type in the FTP window
- Load the new firmware as shown below

NOTE

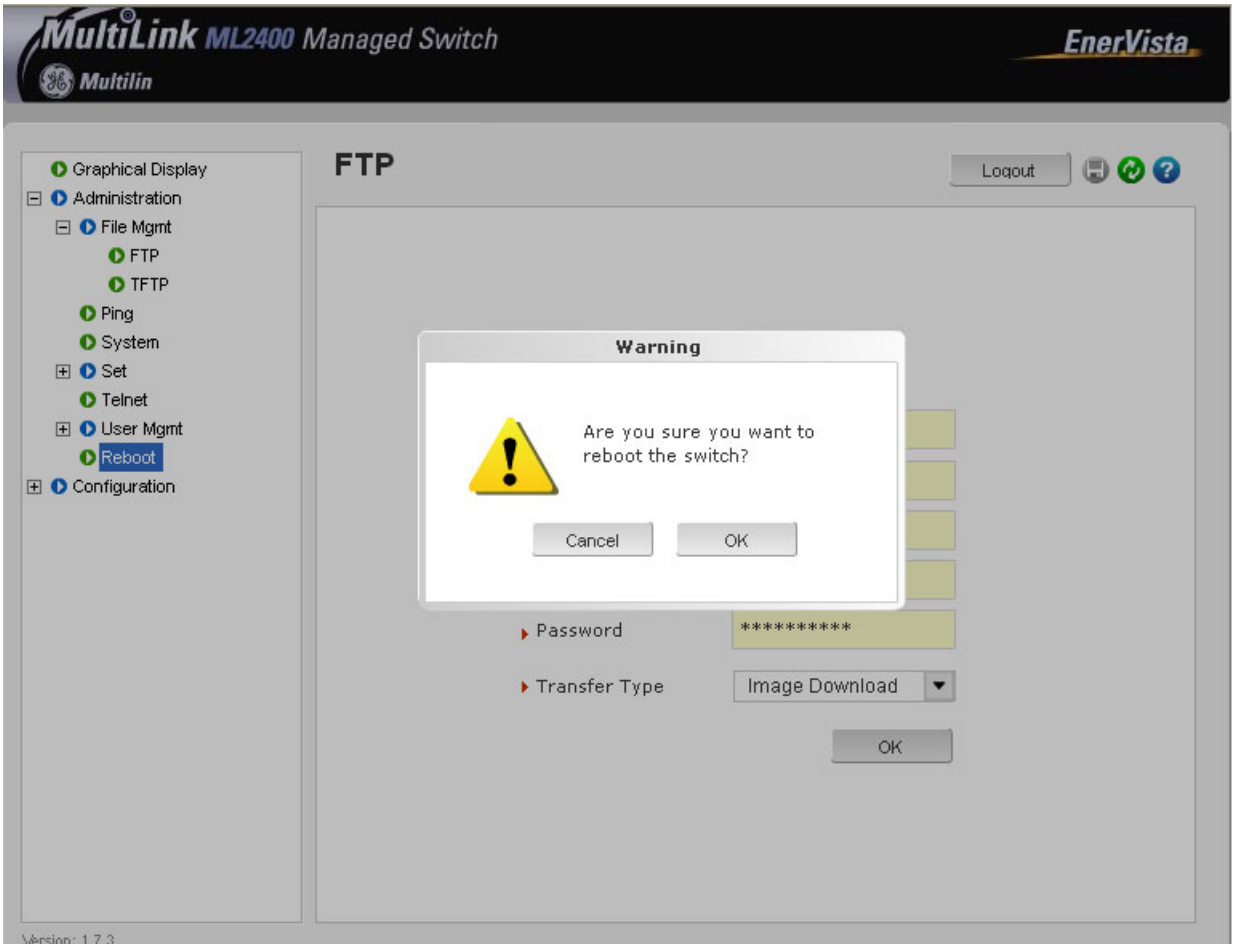
FTP is located under **Configuration > File Mgmnt > FTP,** if the current firmware is older than 1.7.3..



As the file is being loaded, you will see the **file transfer in progress** window.



▷ **Once the transfer is complete, the switch needs to be restarted.**



After reboot, the new version of the Multilink firmware is ready for use.

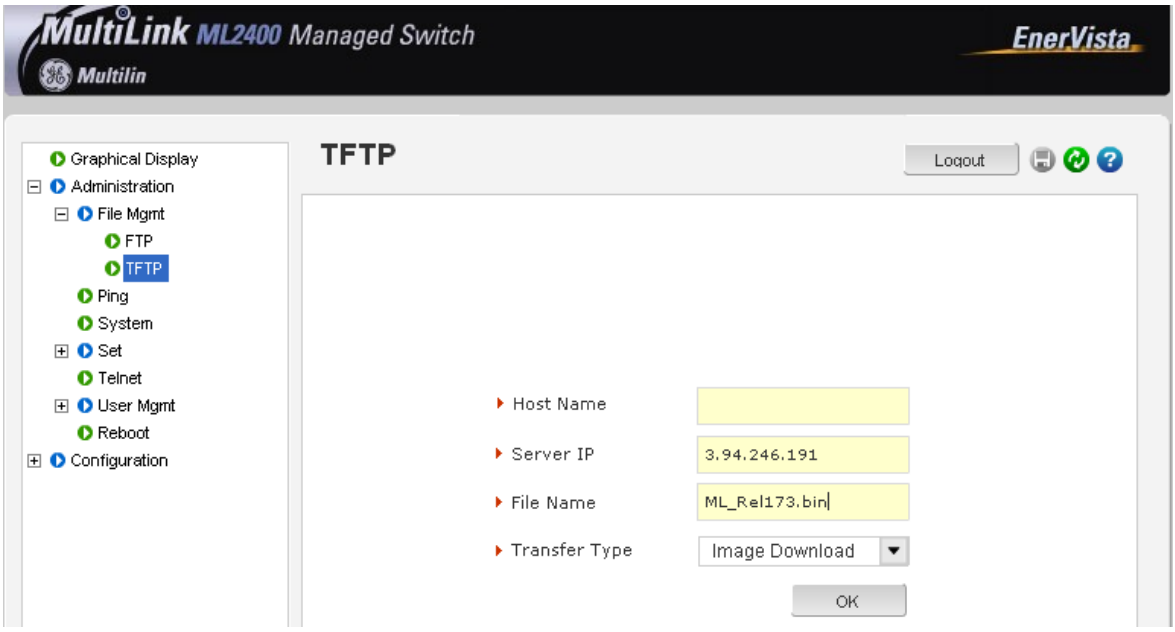
Using TFTP

It is always a good idea to save the configuration before an upgrade. GE Multilin recommends a two-step update: first save the configuration to the ftp server, then load the new image and restart the switch.

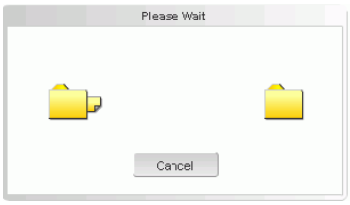
▷ **Load the new firmware as shown below.**

NOTE

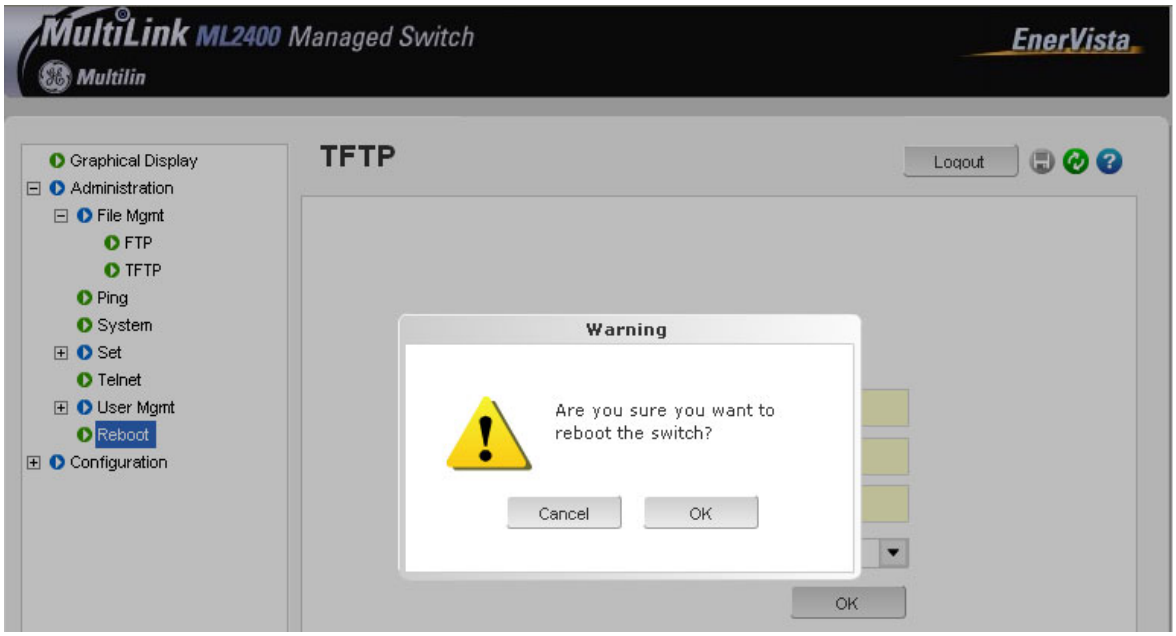
FTP is located under **Configuration > File Mgmnt > TFTP,** if the current firmware is older than 1.7.3.



As the file is being loaded, you will see the **file transfer in progress** window.



▷ **Reboot the switch when the transfer is complete.**



After reboot, the new version of the Multilink firmware is ready for use.